

## **1                                    TERMINAL WITH MULTIPLE AUDIO AND VIDEO**

### **2           Related Applications**

3                    This application is a Divisional of Application Serial No. 08/160,194 filed on  
4           December 2, 1993, which a continuation-in-part of application Serial Number 07/991,074  
5           filed December 9, 1992 entitled TELEVISION PROGRAM PACKAGING AND  
6           DELIVERY SYSTEM WITH MENU DRIVEN SUBSCRIBER ACCESS.

7                    Parent application Serial No. 07/991,074 filed December 9, 1992 is incorporated  
8           herein by reference.

9                    The following continuation-in-part applications, also based on the above-  
10           referenced patent application, are also incorporated herein by reference:

11                   U.S. Patent No. 5,798,785 (Ser. No. 08/160,281), entitled REPROGRAMMABLE  
12           TERMINAL FOR SUGGESTING PROGRAMS OFFERED ON A TELEVISION  
13           PROGRAM DELIVERY SYSTEM, filed on December 2, 1993;

14                   U.S. Patent No. 5,600,364 (Ser. No. 08/160,280), entitled NETWORK  
15           CONTROLLER FOR CABLE TELEVISION DELIVERY SYSTEMS, filed on  
16           December 2, 1993;

17                   U.S. Patent No. 5,659,350 (Ser. No. 08/160,282), entitled AN OPERATIONS  
18           CENTER FOR A TELEVISION PROGRAM PACKAGING AND DELIVERY  
19           SYSTEM, filed on December 2, 1993;

20                   U.S. Patent No. 5,734,853 (Ser. No. 08/160,193), entitled SET TOP TERMINAL  
21           FOR CABLE TELEVISION DELIVERY SYSTEMS, filed on December 2, 1993;

22                   U.S. Patent No. 5,682,195 (Ser. No. 08/160,283), entitled DIGITAL CABLE  
23           HEADEND FOR CABLE TELEVISION DELIVERY SYSTEM, filed on December 2,  
24           1993.

1      Technical Field

2            The invention relates to television entertainment systems for providing television  
3      programming to consumer homes. More particularly, the invention relates to a set top  
4      terminal that provides multiple audio and video capability.

5      Background Of The Invention

6            Advances in television entertainment have been primarily driven by  
7      breakthroughs in technology. In 1939, advances on Vladmir Zworykin's picture tube  
8      provided the stimulus for NBC to begin its first regular broadcasts. In 1975, advances  
9      in satellite technology provided consumers with increased programming to homes.

10           Many of these technology breakthroughs have produced inconvenient systems for  
11      consumers. One example is the ubiquitous three remote control home, having a separate  
12      and unique remote control for the TV, cable box and VCR. More recently, technology  
13      has provided cable users in certain parts of the country with 100 channels of  
14      programming. This increased program capacity is beyond the ability of many consumers  
15      to use effectively. No method of managing the program choices has been provided to  
16      consumers.

17           Consumers are demanding that future advances in television entertainment,  
18      particularly programs and program choices, be presented to the consumer in a user  
19      friendly manner. Consumer preferences, instead of technological breakthroughs, will  
20      drive the television entertainment market for at least the next 20 years. As computer  
21      vendors have experienced a switch from marketing new technology in computer hardware  
22      to marketing better usability, interfaces and service, the television entertainment industry  
23      will also experience a switch from new technology driving the market to consumer  
24      usability driving the market.

25           Consumers want products incorporating new technology that are useful, and will  
26      no longer purchase new technology for the sake of novelty or status. Technological  
27      advances in sophisticated hardware are beginning to surpass the capability of the average

1 consumer to use the new technology. Careful engineering must be done to make  
2 entertainment products incorporating new technology useful and desired by consumers.

3 In order for new television entertainment products to be successful, the products  
4 must satisfy consumer demands. TV consumers wish to go from limited viewing choices  
5 to a variety of choices, from no control of programming to complete control. Consumers  
6 wish to advance from cumbersome and inconvenient television to easy and convenient  
7 television and keep costs down. Consumers do not wish to pay for one hundred channels  
8 when due to lack of programming information, they seldom, if ever, watch programming  
9 on many of these channels.

#### 10 Summary Of Invention

11 The present invention is a set top terminal for a television program delivery  
12 system. The set top terminal is a key component of a digital television program delivery  
13 system. The set top terminal is an ungradable component that provides for the  
14 decompression of multiple digital program signals. The set top terminal also provides  
15 a menu generation capability and a number of other advanced features and functional  
16 capabilities.

17 The set top terminal may be achieved through a set of hardware upgrades to: (1)  
18 an existing set top converter upgraded with a circuit card (which has a microprocessor  
19 electronically connected to the set top converter); (2) an industry standard decompression  
20 converter ungradable by either an upgrade module or a menu generation card; (3) a set  
21 top converter box capable of both decompression and menu generation; and (4) a digital  
22 television. The hardware upgrades provide additional advanced features and functional  
23 capabilities to any of these embodiments.

24 To provide multiple video, the terminal includes two or more terminals and  
25 associated digital signal processing components. The multiple video signals can be  
26 displayed on a television in a multi-window format (e.g., side-by-side) or in an overlay  
27 fashion. Each video signal may have an associated audio signal. A subscriber can select  
28 which audio signal to hear using a switch that may be operated remotely using a remote  
29 control.

1           The multiple video signals may also be provided to different televisions. For  
2           example, a first program may be provided to a first television and a second program may  
3           be provided to a second television that may be located in a room different from that have  
4           the first television and the set top terminal.

5           The multiple audio feature also allows a subscriber to select one of several  
6           languages for the audio presentation. The available languages may be listed in an on-  
7           screen menu, and the subscriber chooses the desired language using the remote control.

8           The set top terminal also supports a TV guide service, which provides subscribers  
9           with information on all programming available at its particular subscriber location. The  
10          set top terminal further includes the capability of querying viewers to establish, among  
11          other things, favorite channel lists, personal profile data and mood information. The set  
12          top terminal allows the subscriber to view promotional menus on future programming  
13          events.

14          The set top terminal supports additional capabilities using its hardware upgrades  
15          that allow subscribers to use other interactive services, for example, to engage in on-line  
16          question and answer sessions, to order and confirm airline tickets, and to access a variety  
17          of other data services. The set top terminal makes use of a digital tuner as a hardware  
18          upgrade to provide subscribers with a digital audio capability.

19          The set top terminal may be used to control video tape machines, thereby  
20          simplifying the recording of programs. The set top terminal can, in conjunction with the  
21          program delivery system, easily support high definition television (HDTV). For  
22          subscribers living in remote locations, the set top terminal accommodates backyard  
23          satellite systems. In addition to all the features that the set top terminal supports with its  
24          current internal programming and upgrade ability, additional features may be added or  
25          existing features increased through remote reprogramming of the set top terminal.

#### 26          Description Of The Drawings

27                 Figure 1 is a diagram of the primary components of the television delivery system.

28                 Figure 2 is an overview of the television delivery system operations.

29                 Figure 3 is a schematic of the operation of the primary components of the system.

1 Figure 4 is a block diagram of the hardware components of the set top terminal.

2 Figure 5a is a perspective front view of a set top terminal.

3 Figure 5b is a perspective rear view of a set top terminal.

4 Figure 6 is a schematic of a Turbo Card upgrade for a set top terminal.

5 Figure 7a is a drawing of a frame format for program control information signal.

6 Figure 7b is a drawing of a frame format for a polling response from the set top  
7 terminal.

8 Figure 8 is a drawing of the basic menus used in the present invention, including  
9 the ten major menus represented by icons.

10 Figure 9a is a schematic of a basic decompression box with upgrade module and  
11 associated connections.

12 Figure 9b is a schematic of an alternative embodiment of a simple decompression  
13 box with upgrade module and associated connections.

14 Figure 10 is a more detailed block diagram of the components of a simple  
15 decompression box with upgrade module.

16 Figure 11 is a schematic of the set top terminal's upstream data transmission  
17 hardware.

18 Figure 12a is a schematic showing the components of the Level A, B, and C  
19 hardware upgrades.

20 Figure 12b is a schematic showing the components of the Level D hardware  
21 upgrade.

22 Figure 13a is a schematic showing the two parts of a remote control unit.

23 Figure 13b is a drawing of the preferred remote control unit.

24 Figure 14 is a diagram of the components of a set top terminal having a picture-  
25 on-picture capability.

26 Figure 15 is a drawing of a menu related to program catalogue services.

27 Figures 16a through 16d are drawings of viewer querying and mood question  
28 menus.

1           Figures 17a and 17b are drawings of the set top terminal hardware components  
2 that accommodate transparent channel switching.

3           Figure 18 is a drawing of an interactive television promotional menu for a set top  
4 terminal hardware upgrade.

5           Figures 19a and 19b are drawings of submenus for interactive television services  
6 using hardware upgrade Level A.

7           Figures 20a through 20d are drawings of interactive services using hardware  
8 upgrade Level B, which are related to on-screen airline reservations.

9           Figure 21 is a drawing of a menu for digital audio services.

10          Figure 22 is a drawing of a menu related to program guide services.

11          Figure 23 is a drawing of a menu related to high definition television (HDTV)  
12 programming.

### 13 Detailed Description Of The Preferred Embodiment

#### 14 A. Television Program Delivery System Description

##### 15 1. Introduction

16          Figure 1 shows the present invention as part of an expanded cable television  
17 program delivery system 200 that dramatically increases programming capacity using  
18 compressed transmission of television program signals. Developments in digital  
19 bandwidth compression technology now allow much greater throughput of television  
20 program signals over existing or slightly modified transmission media. The program  
21 delivery system 200 shown provides subscribers with a user friendly interface to operate  
22 and exploit a six-fold or more increase in current program delivery capability

23          Subscribers are able to access an expanded television program package and view  
24 selected programs through a menu-driven access scheme that allows each subscriber to  
25 select individual programs by sequencing a series of menus. The menus are sequenced  
26 by the subscriber using simple alpha-numeric and iconic character access or moving a  
27 cursor or highlight bar on the TV screen to access desired programs by simply pressing  
28 a single button, rather than recalling from memory and pressing the actual two or more  
29 digit numeric number assigned to a selection. Thus, with the press of a single button, the

1 subscriber can advance from one menu to the next. In this fashion, the subscriber can  
2 sequence the menus and select a program from any given menu. The programs are  
3 grouped by category so that similar program offerings are found on the same menu.

4 In one embodiment, it is a system to provide a subscriber interactive services with  
5 a remotely located computer using a series of individual menus, comprising means for  
6 generating menu control information in digitally compressed form; means for  
7 transmitting the digitally compressed menu control information; a television terminal for  
8 displaying menus on a television comprising a decompressor for decompressing the menu  
9 control information; a menu generator for generating menus from the menu control  
10 information; a means for interactively entering information using generated menus;  
11 means for communicating with the remotely located computer; means for receiving data  
12 from the remotely located computer; and means for integrating the data into menus.

## 13 2. Major System Components

14 In its most basic form, the system uses a program delivery system 200 in  
15 conjunction with a conventional concatenated cable television system 210. The program  
16 delivery system 200 generally includes (i) at least one operations center 202, where  
17 program packaging and control information are created and then assembled in the form  
18 of digital data, (ii) a digital compression system, where the digital data is compressed,  
19 combined/multiplexed, encoded, and mapped into digital signals for satellite transmission  
20 to the cable headend 208, and (iii) a set of in-home decompressors. The program delivery  
21 system 200 transports the digital signals to the cable headend 208 where the signals are  
22 transmitted through a concatenated cable television system 210. Within the cable  
23 headend 208, the received signals may be decoded, demultiplexed, managed by a local  
24 central distribution and switching mechanism, combined and then transmitted to the set  
25 top terminal 220 located in each subscriber's home over the cable system 210. Although  
26 concatenated cable systems 210 are the most prevalent transmission media to the home,  
27 telephone lines, cellular networks, fiberoptics, Personal Communication Networks and  
28 similar technology for transmitting to the home can be used interchangeably with this  
29 program delivery system 200.

1           The delivery system 200 has a reception region 207 with an in-home  
2       decompression capability. This capability is performed by a decompressor housed within  
3       a set top terminal 220 in each subscriber's home. The decompressor remains transparent  
4       from the subscriber's point of view and allows any of the compressed signals to be  
5       demultiplexed and individually extracted from the composite data stream and then  
6       individually decompressed upon selection by the subscriber. The decompressed video  
7       signals are converted into analog signals for television display. Such analog signals  
8       include NTSC formatted signals for use by a standard television. Control signals are  
9       likewise extracted and decompressed and then either executed immediately or placed in  
10      local storage such as a RAM. Multiple sets of decompression hardware may be used to  
11      decompress video and control signals. The set top terminal 220 may then overlay or  
12      combine different signals to form the desired display on the subscriber's television.  
13      Graphics on video or picture-on-picture are examples of such a display.

14           Although a single digital compression standard (e.g., MPEG) may be used for  
15      both the program delivery system 200 and the concatenated cable system 210, the  
16      compression technique used may differ between the two systems. When the compression  
17      standards differ between the two media, the signals received by the cable headend 208  
18      must be decompressed before transmission from the headend 208 to the set top terminals  
19      220. Subsequently, the cable headend 208 must recompress and transmit the signals to  
20      the set top terminal 220, which would then decompress the signals using a specific  
21      decompression algorithm.

22           The video signals and program control signals received by the set top terminal  
23      220 correspond to specific television programs and menu selections that each subscriber  
24      may access through a subscriber interface. The subscriber interface is a device with  
25      buttons located on the set top terminal 220 or on a portable remote control 900. In the  
26      preferred system embodiment, the subscriber interface is a combined alpha-character,  
27      numeric and iconic remote control device 900, which provides direct or menu-driven  
28      program access. The preferred subscriber interface also contains cursor movement and  
29      go buttons as well as alpha, numeric and iconic buttons. This subscriber interface and



1 menu arrangement enables the subscriber to sequence through menus by choosing from  
2 among several menu options that are displayed on the television screen. In addition, a  
3 user may bypass several menu screens and immediately choose a program by selecting  
4 the appropriate alpha-character, numeric or iconic combinations on the subscriber  
5 interface. In the preferred embodiment, the set top terminal 220 generates the menus that  
6 are displayed on the television by creating arrays of particular menu templates, and the  
7 set top terminal 220 displays a specific menu or submenu option for each available video  
8 signal.

### 9 3. Operations Center and Digital Compression System

10 The operations center 202 performs two primary services, packaging television  
11 programs and generating the program control information signal. At the operations center  
12 202, television programs are received from external program sources in both analog and  
13 digital form. Figure 2 shows an embodiment of the operations center receiving signals  
14 from various external sources 212. Examples of the external program sources are  
15 sporting events, children's programs, specialty channels, news or any other program  
16 source that can provide audio or visual signals. Once the programs are received from the  
17 external program sources, the operations center 202 digitizes (and preferably compresses)  
18 any program signals received in analog form. The operations center 202 may also  
19 maintain an internal storage of programs. The internally stored programs may be in  
20 analog or digital form and stored on permanent or volatile memory sources, including  
21 magnetic tape or RAM. Subsequent to receiving programming, the operations center 202  
22 packages the programs into the groups and categories which provide the optimal  
23 marketing of the programs to subscribers. For example, the operations center 202 may  
24 package the same programs into different categories and menus for weekday, prime-time  
25 viewing and Saturday afternoon viewing. Also, the operations center 202 packages the  
26 television programs in a manner that enables both the various menus to easily represent  
27 the programs and the subscribers to easily access the programs through the menus.

1           The packaging of the digital signals is typically performed at the operations center  
2 202 by computer assisted packaging equipment (CAP). The CAP system normally  
3 includes at least one computer monitor, keyboard, mouse, and standard video editing  
4 equipment. A programmer packages the signals by entering certain information into the  
5 CAP. This information includes the date, time slot, and program category of the various  
6 programs. The programmer and the CAP utilize demographic data and ratings in  
7 performing the packaging tasks. After the programmer selects the various programs from  
8 a pool of available programs and inputs the requisite information, the programmer, with  
9 assistance from the CAP, can select the price and allocate transponder space for the  
10 various programs. After the process is complete, the CAP displays draft menus or  
11 program schedules that correspond to the entries of the programmer. The CAP may also  
12 graphically display allocation of transponder space. The programmer may edit the menus  
13 and transponder allocation several times until satisfied with the programming schedule.  
14 During the editing, the programmer may direct the exact location of any program name  
15 on a menu with simple commands to the CAP.

16           The packaging process also accounts for any groupings by satellite transponder  
17 which are necessary. The operations center 202 may send different groups of programs  
18 to different cable headends 208 and/or set top terminals 220. One way the operations  
19 center 202 may accomplish this task is to send different program packages to each  
20 transponder. Each transponder, or set of transponders, then relays a specific program  
21 package to specific cable headends 208 and/or set top terminals 220. The allocation of  
22 transponder space is an important task performed by the operations center 202.

23           The operations center 202 may also "insert" directions for filling local available  
24 program time in the packaged signal to enable local cable and television companies to fill  
25 the program time with local advertising and/or local programming. Consequently, the  
26 local cable headends 208 are not constrained to show only programs transmitted from the  
27 operations center 202. New set top converters will incorporate both digital and analog  
28 channels. Therefore, the cable headend 208 may combine analog signals with the digital  
29 signals prior to transmitting the program signals to the set top terminals 220.

1 After the CAP packages the programs, it creates a program control information  
2 signal to be delivered with the program package to the cable headend 208 and/or set top  
3 terminal 220. The program control information signal contains a description of the  
4 contents of the program package, commands to be sent to the cable headend 208 and/or  
5 set top terminal 220, and other information relevant to the signal transmission.

6 In addition to packaging the signal, the operations center 202 employs digital  
7 compression techniques to increase existing satellite transponder capacity by at least a 4:1  
8 ratio, resulting in a four-fold increase in program delivery capability. A number of digital  
9 compression algorithms currently exist which can achieve the resultant increase in  
10 capacity and improved signal quality desired for the system. The algorithms generally  
11 use one or more of three basic digital compression techniques: (1) within-frame  
12 (intraframe) compression, (2) frame-to-frame (interframe) compression, and (3) within  
13 carrier compression. Specifically, in the preferred embodiment, the MPEG 2  
14 compression method is used. After digital compression, the signals are combined  
15 (multiplexed) and encoded. The combined signal is subsequently transmitted to various  
16 uplink sites 204.

17 There may be a single uplink site 204 or multiple uplink sites (represented by  
18 204', shown in phantom in Figure 1) for each operation center 202. The uplink sites 204  
19 may either be located in the same geographical place or may be located remotely from the  
20 operations center 202. Once the composite signal is transmitted to the uplink sites 204,  
21 the signal may be multiplexed with other signals, modulated, upconverted and amplified  
22 for transmission over satellite. Multiple cable headends 208 may receive such  
23 transmissions.

24 In addition to multiple uplinks, the delivery system 200 may also contain multiple  
25 operations centers. The preferred method for using multiple operations centers is to  
26 designate one of the operations centers as a master operations center and to designate the  
27 remaining operations centers as slave operations centers. In this configuration, the master  
28 operations center coordinates various functions among the slave operations centers such

1 as synchronization of simultaneous transmissions and distributes the operations workload  
2 efficiently.

#### 3 4. Cable Headend

4 After the operations center 202 has compressed and encoded the program signals  
5 and transmitted the signals to the satellite, the cable headend 208 receives and further  
6 processes the signals before they are relayed to each set top terminal 220. Each cable  
7 headend site is generally equipped with multiple satellite receiver dishes. Each dish is  
8 capable of handling multiple transponder signals from a single satellite and sometimes  
9 from multiple satellites.

10 As an intermediary between the set top terminals 220 and the operations center  
11 202 (or other remote site), the cable headend 208 performs two primary functions. First,  
12 the cable headend 208 acts as a distribution center, or signal processor, by relaying the  
13 program signal to the set top terminal 220 in each subscriber's home. In addition, the  
14 cable headend 208 acts as a network controller 214 by receiving information from each  
15 set top terminal 220 and passing such information on to an information gathering site  
16 such as the operations center 202.

17 Figure 3 shows an embodiment where the cable headend 208 and the subscriber's  
18 home are linked by certain communications media 216. In this particular embodiment,  
19 analog signals, digitally compressed signals, other digital signals and up-  
20 stream/interactivity signals are sent and received over the media 216. The cable headend  
21 208 provides such signaling capabilities in its dual roles as a signal processor 209 and  
22 network controller 214.

23 As a signal processor 209, the cable headend 208 prepares the program signals  
24 that are received by the cable headend 208 for transmission to each set top terminal 220.  
25 In the preferred system, the signal processor 209 re-routes or demultiplexes and  
26 recombines the signals and digital information received from the operations center 202  
27 and allocates different portions of the signal to different frequency ranges. Cable  
28 headends 208 which offer different subscribers different program offerings may allocate  
29 the program signals from the operations center 202 in various manners to accommodate

1 different viewers. The signal processor 209 may also incorporate local programming  
2 and/or local advertisements into the program signal and forward the revised signal to the  
3 set top terminals 220. To accommodate this local programming availability, the signal  
4 processor 209 must combine the local signal in digital or analog form with the operations  
5 center program signals. If the local cable system uses a compression standard that is  
6 different than the one used by the operations center 202, the signal processor 209 must  
7 also decompress and recompress incoming signals so they may be properly formatted for  
8 transmission to the set top terminals 220. This process becomes less important as  
9 standards develop (i.e., MPEG 2). In addition, the signal processor 209 performs any  
10 necessary signal decryption and/or encryption.

11 As a network controller 214, the cable headend 208 performs the system control  
12 functions for the system. The primary function of the network controller 214 is to  
13 manage the configuration of the set top terminals 220 and process signals received from  
14 the set top terminals 220. In the preferred embodiment, the network controller 214  
15 monitors, among other things, automatic poll-back responses from the set top terminals  
16 220 remotely located at each subscribers' home. The polling and automatic report-back  
17 cycle occurs frequently enough to allow the network controller 214 to maintain accurate  
18 account and billing information as well as monitor authorized channel access. In the  
19 simplest embodiment, information to be sent to the network controller 214 will be stored  
20 in RAM within each subscriber's set top terminal 220 and will be retrieved only upon  
21 polling by the network controller 214. Retrieval may, for example, occur on a daily,  
22 weekly or monthly basis. The network controller 214 allows the system to maintain  
23 complete information on all programs watched using a particular set top terminal 220.

24 The network controller 214 is also able to respond to the immediate needs of a set  
25 top terminal 220 by modifying a program control information signal received from the  
26 operations center 202. Therefore, the network controller 214 enables the delivery system  
27 to adapt to the specific requirements of individual set top terminals 220 when the  
28 requirements cannot be provided to the operations center 202 in advance. In other words,  
29 the network controller 214 is able to perform "on the fly programming" changes. With

1 this capability, the network controller 214 can handle sophisticated local programming  
2 needs such as, for example, interactive television services, split screen video, and  
3 selection of different foreign languages for the same video. In addition, the network  
4 controller 214 controls and monitors all compressors and decompressors in the system.

5 The delivery system 200 and digital compression of the preferred embodiment  
6 provides a one-way path from the operations center 202 to the cable headend 208. Status  
7 and billing information is sent from the set top terminal 220 to the network controller 214  
8 at the cable headend 208 and not directly to the operations center 202. Thus, program  
9 monitoring and selection control will take place only at the cable headend 208 by the  
10 local cable company and its decentralized network controllers 214 (i.e., decentralized  
11 relative to the operations center 202, which is central to the program delivery system  
12 200). The local cable company will in turn be in communication with the operations  
13 center 202 or a regional control center (not shown) which accumulates return data from  
14 the set top terminal 220 for statistical or billing purposes. In alternative system  
15 embodiments, the operations center 202 and the statistical and billing sites are collocated.  
16 Further, telephone lines with modems are used to transfer information from the set top  
17 terminal 220 to the statistical and billing sites.

#### 18 5. Set Top Terminal

19 The set top terminal 220 is the portion of the delivery system 200 that resides in  
20 the home of a subscriber. The set top terminal 220 is usually located above or below the  
21 subscriber's television, but it may be placed anywhere in or near the subscriber's home  
22 as long as it is within the range of the subscriber's remote control device 900. In some  
23 aspects, the set top terminal 220 may resemble converter boxes already used by many  
24 cable systems. For instance, each set top terminal 220 may include a variety of error  
25 detection, decryption, and coding techniques such as anti-taping encoding. However, it  
26 will become apparent from the discussion below that the set top terminal 220 is able to  
27 perform many functions that an ordinary converter box cannot perform.

28 The set top terminal 220 has a plurality of input and output ports to enable it to  
29 communicate with other local and remote devices. The set top terminal 220 has an input

1 port that receives information from the cable headend 208. In addition, the unit has at  
2 least two output ports which provide communications from the set top terminal 220 to  
3 a television and a VCR. Certain menu selections may cause the set top terminal 220 to  
4 send control signals directly to the VCR to automatically program or operate the VCR.  
5 Also, the set top terminal 220 contains a phone jack which can be used for maintenance,  
6 trouble shooting, reprogramming and additional customer features. The set top terminal  
7 220 may also contain stereo/audio output terminals and a satellite dish input port.

8 Functionally, the set top terminal 220 is the last component in the delivery system  
9 chain. The set top terminal 220 receives compressed program and control signals from  
10 the cable headend 208 (or, in some cases, directly from the operations center 202). After  
11 the set top terminal 220 receives the individually compressed program and control  
12 signals, the signals are demultiplexed, decompressed, converted to analog signals (if  
13 necessary) and either placed in local storage (from which the menu template may be  
14 created), executed immediately, or sent directly to the television screen.

15 After processing certain signals received from the cable headend 208, the set top  
16 terminal 220 is able to store menu templates for creating menus that are displayed on a  
17 subscriber's television by using an array of menu templates. Before a menu can be  
18 constructed, menu templates must be created and sent to the set top terminal 220 for  
19 storage. A microprocessor uses the control signals received from the operations center  
20 202 or cable headend 208 to generate the menu templates for storage. Each menu  
21 template may be stored in volatile memory in the set top terminal 220. When the set top  
22 terminal receives template information it demultiplexes the program control signals  
23 received from the cable headend 208 into four primary parts: video, graphics, program  
24 logic and text. Each menu template represents a different portion of a whole menu, such  
25 as a menu background, television logo, cursor highlight overlay, or other miscellaneous  
26 components needed to build a menu. The menu templates may be deleted or altered using  
27 control signals received from the operations center 202 or cable headend 208.

28 Once the menu templates have been stored in memory, the set top terminal 220  
29 can generate the appropriate menus. In the preferred embodiment, the basic menu format

1 information is stored in memory located within the set top terminal 220 so that the  
2 microprocessor may locally access the information from the set top terminal instead of  
3 from an incoming signal. The microprocessor next generates the appropriate menus from  
4 the menu templates and the other menu information stored in memory. The set top  
5 terminal 220 then displays specific menus on the subscriber's television screen that  
6 correspond to the inputs the subscriber selects.

7 If the subscriber selects a specific program from a menu, the set top terminal 220  
8 determines on which channel the program is being shown, demultiplexes and extracts the  
9 single channel transmitted from the cable headend 208. The set top terminal 220 then  
10 decompresses the channel and, if necessary, converts the program signal to an analog  
11 NTSC signal to enable the subscriber to view the selected program. The set top terminal  
12 220 can be equipped to decompress more than one program signal, but this would  
13 unnecessarily add to the cost of the unit since a subscriber will generally only view one  
14 program at a time. However, two or three decompressors may be desirable to provide  
15 picture-on-picture capability, control signal decompression, enhanced channel switching  
16 or like features.

17 In addition to menu information, the set top terminal 220 may also store text  
18 transmitted from the cable headend 208 or the operations center 202. The text may  
19 inform the subscriber about upcoming events, billing and account status, new  
20 subscriptions, or other relevant information. The text will be stored in an appropriate  
21 memory location depending on the frequency and the duration of the use of the textual  
22 message.

23 Also, optional upgrades are available to enhance the performance of a subscriber's  
24 set top terminal 220. These upgrades may consist of a cartridge or computer card (not  
25 shown) that is inserted into an expansion slot in the set top terminal 220 or may consist  
26 of a feature offered by the cable headend 208 or operations center 202 to which the user  
27 may subscribe. Available upgrades may include on line data base services, interactive  
28 multi-media services, access to digital radio channels, and other services.



1 In the simplest embodiment, available converter boxes such as those  
2 manufactured by General Instruments or Scientific Atlanta, may be modified and  
3 upgraded to perform the functions of a set top terminal 220. The preferred upgrade is a  
4 circuit card with a microprocessor which is electronically connected to or inserted into  
5 the converter box.

#### 6 6. Remote Control Device

7 The primary conduit for communication between the subscriber and the set top  
8 terminal 220 is through the subscriber interface, preferably a remote control device 900.  
9 Through this interface, the subscriber may select desired programming through the  
10 system's menu-driven scheme or by directly accessing a specific channel by entering the  
11 actual channel number. Using the interface, the subscriber can navigate through a series  
12 of informative program selection menus. By using menu-driven, iconic or alpha-  
13 character access, the subscriber can access desired programs by simply pressing a single  
14 button rather than recalling from memory and pressing the actual channel number to  
15 make a selection. The subscriber can access regular broadcast and basic cable television  
16 stations by using either the numeric keys on the remote control 900 (pressing the  
17 corresponding channel number), or one of the menu icon selection options.

18 In addition to enabling the subscriber to easily interact with the cable system 200,  
19 the physical characteristics of the subscriber interface 900 should also add to the user  
20 friendliness of the system. The remote control 900 should easily fit in the palm of the  
21 user's hand. The buttons of the preferred remote control 900 contain pictorial symbols  
22 that are easily identifiable by the subscriber. Also, buttons that perform similar functions  
23 may be color coordinated and consist of distinguishing textures to increase the user  
24 friendliness of the system.

#### 25 7. Menu-Driven Program Selection

26 The menu-driven scheme provides the subscriber with one-step access to all major  
27 menus, ranging from hit movies to sport specials to specialty programs. From any of the  
28 major menus, the subscriber can in turn access submenus and minor menus by cursor or  
29 alpha-character access.

1           There are two different types of menus utilized by the preferred embodiment, the  
2 Program Selection menus and the During Program menus. The first series of menus,  
3 Program Selection menus, consists of an Introductory, a Home, Major menus, and  
4 Submenus. The second series of menus, During Program menus, consists of two primary  
5 types, Hidden menus and the Program Overlay menus.

6           Immediately after the subscriber turns on the set top terminal 220, the  
7 Introductory menu welcomes the subscriber to the system. The Introductory menu may  
8 display important announcements from the local cable franchise, advertisements from the  
9 cable provider, or other types of messages. In addition, the Introductory menu can inform  
10 the subscriber if the cable headend 208 has sent a personal message to the subscriber's  
11 particular set top terminal 220.

12           After the Introductory menu has been displayed the subscriber may advance to the  
13 next level of menus, namely the Home menu. In the preferred embodiment, after a  
14 certain period of time, the cable system will advance the subscriber by default to the  
15 Home menu. From the Home menu, the subscriber is able to access all of the  
16 programming options. The subscriber may either select a program directly by entering  
17 the appropriate channel number from the remote control 900, or the subscriber may  
18 sequence through incremental levels of menu options starting from the Home menu. The  
19 Home menu lists categories that correspond to the first level of menus called Major  
20 menus.

21           If the subscriber chooses to sequence through subsequent menus, the subscriber  
22 will be forwarded to the Major menu that corresponds to the chosen category from the  
23 Home menu. The Major menus further refine a subscriber's search and help guide the  
24 subscriber to the selection of his choice.

25           From the Major menus, the subscriber may access several submenus. From each  
26 submenu, the subscriber may access other submenus until the subscriber finds a desired  
27 television program. Similar to the Major menu, each successive level of Submenus  
28 further refines the subscriber's search. The system also enables the subscriber to skip

1 certain menus or submenus and directly access a specific menu or television program by  
2 entering the appropriate commands on the remote control 900.

3 The During program menus (including Hidden Menus and Program Overlay  
4 Menus) are displayed by the set top terminal 220 only after the subscriber has selected  
5 a television program. In order to avoid disturbing the subscriber, the set top terminal 220  
6 does not display the Hidden Menus until the subscriber selects the appropriate option to  
7 display a Hidden Menu. The Hidden Menus contain options that are relevant to the  
8 program selected by the viewer. For example, a Hidden Menu may contain options that  
9 enable a subscriber to enter an interactive mode or escape from the selected program.

10 Program Overlay Menus are similar to Hidden Menus because they occur during  
11 a program and are related to the program being viewed. However, the Program Overlay  
12 Menus are displayed concurrently with the program selected by the subscriber. Most  
13 Program Overlay Menus are small enough on the screen to allow the subscriber to  
14 continue viewing the selected program comfortably.

15 B. Detailed Set Top Terminal Description

16 The set top terminal 220 receives and manipulates signals from the cable headend  
17 208. The set top terminal 220 is equipped with local computer memory and the capability  
18 of interpreting the digitally compressed signal to produce menus for the subscriber. The  
19 remote control 900 communicates the subscriber's selections to the set top terminal 220.  
20 The subscriber's selections are generally based upon menus or other prompts displayed  
21 on the television screen.

22 It is preferred that the signal reaches the subscriber's home in a compressed  
23 format and is decompressed prior to viewing. Included in the delivered program signal  
24 is information that enables equipment at the subscriber's home to display menus for  
25 choosing particular programs. Depending on the particular embodiment, the television  
26 program signal may arrive at the subscriber's home through one or more connections  
27 such as coaxial cables, fiber cables, twisted pairs, cellular telephone connections, or  
28 personal communications network (PCN) hookups.

1           The program control information signal is generated by the operations center 202  
2           and provides the network controller 214 with data on the scheduling and description of  
3           programs. In an alternate configuration, this data is sent directly to the set top terminal  
4           220 for display to the subscriber. In the preferred embodiment, the program control  
5           information signal is stored and modified by the network controller 214 and sent to the  
6           set top terminal 220 in the form of a set top terminal control information stream  
7           (STTCIS). The set top terminal 220 integrates either the program control information  
8           signal or the STTCIS with data stored in the memory of the set top terminal 220 to  
9           generate on-screen menus that assist the subscriber in choosing programs for display.

10           The types of information that can be sent using the program control signal  
11           include: number of program categories, names of program categories, what channels are  
12           assigned to a specific category (such as specialty channels), names of channels, names  
13           of programs on each channel, program start times, length of programs, description of  
14           programs, menu assignment for each program, pricing, whether there is a sample video  
15           clip for advertisement for the program, and any other program, menu or product  
16           information.

17           With a minimal amount of information being communicated to the set top  
18           terminal 220 on a regular basis, the set top terminal 220 is able to determine the proper  
19           menu location for each program and the proper time and channel to activate for the  
20           subscriber after a menu selection. The program control information signal and STTCIS  
21           can be formatted in a variety of ways and the on-screen menus can be produced using  
22           many different methods. For instance, if the program control information signal carries  
23           no menu format information, the menu format for creating the menus can be fixed in  
24           ROM at the set top terminal 220. In the preferred embodiment, the menu format  
25           information is stored at the set top terminal 220 in a temporary memory device such as  
26           a RAM or EPROM. New menu format information is sent via the program control  
27           information signal or the STTCIS to the set top terminals 200 whenever a change to a  
28           menu format is desired.

1 In the simplest embodiment, the menu formats remain fixed and only the text  
2 changes. In this way the program control information signal can be limited to primarily  
3 text and a text generator can be employed in the set top terminal 220. Another simple  
4 embodiment uses a separate channel full-time (large bandwidth) just for the menu  
5 information.

6 Live video signals may be used in windows of certain menus. These video signals  
7 can be transmitted using the program control information signal or STTCIS, or can be  
8 taken off channels being transmitted simultaneously with the menu display. Video for  
9 menus, promos or demos may be sent to the set top terminal 220 in several formats,  
10 including (1) on a dedicated channel, (2) on a regular program channel and scaled to size,  
11 or (3) along with the program control information signal. However, in the preferred  
12 embodiment, a large number of short promos or demo video is sent using a split screen  
13 technique on a dedicated channel. A multiple window technique may be used with the  
14 menus to display a description of a program and one or more video frames that assist the  
15 subscriber in selecting the program.

16 Figure 4 shows the basic hardware components of the set top terminal 220. The  
17 set top terminal 220 has a tuner 603, digital demodulator 606, decryptor 600, and  
18 demultiplexers 609, 616 as well as audio equipment 612 and a remote control interface  
19 626 for receiving and processing signals from the remote control unit 900. An optional  
20 modem 627 allows communication between a microprocessor 602 and the cable headend  
21 208. An NTSC encoder 625 provides a standard NTSC video output.

22 The microprocessor 602 is capable of executing program instructions stored in  
23 memory. These instructions allow a user to access various menus by making selections  
24 on the remote control 900.

25 The manner in which the video is decompressed and the menus are generated  
26 from the program control information signal or STTCIS varies depending on the specific  
27 embodiment of the invention. Video decompressors 618 and 622 may be used if the  
28 video is compressed. The program control information signal may be demultiplexed into

1 its component parts, and a video decompressor 618, graphic decompressor, text generator  
2 and video combiner 624 may be used to assist in creating the menus.

3 In addition to the menu format information that is stored in graphics memory, the  
4 set top terminal 220 also stores data, tracking those programs that have been selected for  
5 viewing. By gathering this data, the set top terminal 220 can maintain an accurate record  
6 of all programs accessed/watched by storing the data in EEPROM or RAM.  
7 Subsequently, this data can be transmitted to the cable headend 208, where it can be used  
8 in carrying out network control and monitoring functions. Such data transmissions  
9 between the set top terminal 220 and cable headend 208 can be accomplished, for  
10 example, through upstream transmission over the cable network or over telephone lines  
11 through the use of telephone modems. Where upstream transmission over the cable  
12 network is used, the set top terminals 220 can complete data transmissions on a scheduled  
13 (e.g., using a polling response or status report to respond to polling requests sent from the  
14 cable headend 208) or as-needed (e.g., using a random access technique) basis.

15 Figure 5a shows the front panel of the set top terminal 220, which includes an  
16 infrared sensor 630 and a series of LED displays 640. The LED displays 640 may  
17 indicate with an icon or a letter (e.g. A-K) the major menu currently selected by the set  
18 top terminal 220 or the channels selected directly by a user, or menu channel selections  
19 (e.g., from 1 to 50). Further displays may include current channel, time, volume level,  
20 sleep time, parental lock (security), account balance, use of a hardware upgrade, second  
21 channel being recorded by VCR, use of the Level D music hardware upgrade in a separate  
22 room, and any other displays useful to a subscriber to indicate the current status of the set  
23 top terminal 220. The LEDs 640 may also provide an indication of the digital audio  
24 channel currently tuned.

25 The set top terminal 220 includes a flapped opening 635 on its front that allows  
26 the insertion of a magnetic cartridge (or similar portable storage device, including optical  
27 disk, ROM, EPROM, etc. not shown). This cartridge opening 635 allows the set top  
28 terminal 220 to be upgraded or reprogrammed locally with the use of a magnetic tape  
29 cartridge.

1           On the top or cover of the set top terminal 220 are located pushbutton controls  
2 645. Any function that can be performed on the remote 900 may also be performed at the  
3 set top terminal 220 using the duplicative pushbutton controls 645.

4           Figure 5b shows the back of the set top terminal 220, which includes a pair of  
5 output terminals 650, pair of input terminals 652, pair of stereo/audio output terminals  
6 654, satellite dish input port 656, telephone jack 658 and an RS-422 port 660. In  
7 addition, an upgrade port 662 and a cover plate 664 are held in place by a series of sheet  
8 metal screws. One of the output terminals 650 is for a television and the other is for a  
9 VCR. The set top terminal 220 is equipped to handle incoming signals on one or two  
10 cables using the input terminals 652. The phone jack 658 and an RS-232 or RS-422 port  
11 660 are provided for maintenance, trouble shooting, reprogramming and additional  
12 customer features. In alternate embodiments, the telephone jack 658 may be used as the  
13 primary mode of communication between the cable headend 208 and the set top terminal  
14 220. This connection is possible through the local telephone, cellular telephone or a  
15 personal communications network (PCN).

16           The basic programming of each set top terminal 220 is located on ROM within  
17 the set top terminal 220. Random access memory, the magnetic cartridge capability, and  
18 the expansion card slot 635 each allow upgrades and changes to be easily made to the set  
19 top terminal 220.

20           In the preferred embodiment, the set top terminal 220 includes a hardware  
21 upgrade port 662, in addition to expansion card slots. The hardware upgrade port 662  
22 accommodates a four-wire (or more) connection for: (1) error corrected, decrypted data  
23 output of the set top terminal 220, (2) a control interface, (3) decompressed video output,  
24 and (4) a video input port. In the preferred embodiment, multiple wires are used to  
25 perform each of the four functions. The four sets of wires are combined in a single cable  
26 with a single multipin connector.

27           In the preferred embodiment, multipin connections may be used for the multiwire  
28 cable. The multipin connection 662 may range from DB9 to DB25. A variety of small

1 computer systems interface (SCSI) ports may also be provided. Alternatively, four or  
2 more ports may be provided instead of the single port depicted.

3 Another port 662 is used to attach the various hardware upgrades described below  
4 to a set top terminal 220. The preferred embodiment has a number of hardware upgrades  
5 available for use with a set top terminal 220, including: (1) a Level A interactive unit,  
6 (2) a Level B interactive unit, (3) a Level C interactive unit with compact disc capability,  
7 (4) a Level D digital radio tuner for separate room use, and (5) a Level E information  
8 download unit. Each of these upgrades may be connected to the set top terminal 220 unit  
9 through the upgrade port 662 described earlier. The same four wires in a single cable  
10 described earlier may be used.

11 Existing set top converter boxes such as those made by Scientific Atlanta or  
12 General Instruments are presently unequipped to handle the menu selection system of the  
13 present invention. Thus, hardware modifications are necessary in order to use the menu  
14 selection system with existing set top converter technology.

15 A Turbo Card addition to a set top converter is depicted in Figure 6. The Turbo  
16 Card 700 shown provides the additional functionality needed to utilize the menu system  
17 with existing set top converter technology. The primary functions the Turbo Card 700  
18 adds to the set top converter are the interpreting of program control information signals,  
19 generating of menus, sequencing of menus, and, ultimately, the ability of the viewer to  
20 select a channel through the menu system without entering any channel identifying  
21 information. The turbo card also provides a method for a remote location, such as the  
22 cable headend 208, to receive information on programs watched and control the operation  
23 of the set top converter and Turbo Card 700. The programs watched information and  
24 control commands may be passed from the cable headend 208 to the Turbo Card 700  
25 using telephone lines.

26 The primary components of the Turbo Card 700 are a PC chip CPU 702, a VGA  
27 graphic controller 704, a video combiner 706, logic circuitry 708, NTSC encoder 710, a  
28 receiver 712, demodulator 714, and a dialer 716. The Turbo Card 700 operates by  
29 receiving the program control information signal from the cable headend 208 through the



1 coaxial cable. The logic circuitry 708 of the Turbo Card 700 receives data, infrared  
2 commands, and synchronization signals from the set top converter. Menu selections  
3 made by the viewer on the remote control 900 are received by the set top converter's IR  
4 equipment and passed through to the Turbo Card 700. The Turbo Card 700 interprets the  
5 IR signal and determines the program (or menu) the viewer has selected. The Turbo Card  
6 700 modifies the IR command to send the program selection information to the set top  
7 converter 221. The modified IR command contains the channel information needed by  
8 the set top converter. Using the phone line and dialer 716, the Turbo Card 700 is able to  
9 transmit program access information to the cable headend 208.

10 In the preferred embodiment, program access information, that is what programs  
11 the viewer watched, is stored at each set top terminal 220 until it is polled by the network  
12 controller 214 using a polling request message format as shown in Figure 7a. This frame  
13 format 920 consists of six fields, namely: (1) a leading flag 922 at the beginning of the  
14 message, (2) an address field 924, (3) a subscriber region designation 926, (4) a set top  
15 terminal identifier 928 that includes a polling command/response (or P/F) bit 930, (5) an  
16 information field 932, and (6) a trailing flag 934 at the end of the message. Figure 7b  
17 shows a response frame format 920' (similar to the frame format 920 end, therefore,  
18 commonly numbered with the frame depicted in Figure 7a, but with the prime indicator  
19 added for clarity) for information communicated by the set top terminal 220 to the  
20 network controller 214 in response to the polling request of Figure 7a.

21 The eight-bit flag sequence 922 that appears at the beginning and end of a frame  
22 is used to establish and maintain synchronization. Such a sequence typically consists of  
23 a "01111110" bit-stream. The address field 924 designates a 4-bit address for a given set  
24 top terminal 220. The subscriber region designation 926 is a 4-bit field that indicates the  
25 geographical region in which the subscriber's set top terminal 220 is housed. The set top  
26 terminal identifier 928 is a 16-bit field that uniquely identifies each set top terminal 220  
27 with a 15-bit designation followed by an appended P/F bit 930. Although field size is  
28 provided by this example, a variety of sizes can be used with the present invention.

1           The P/F bit 930 is used to command a polling response from the set top terminal  
2 220 addressed, as described below. The response frame format 920' also provides a  
3 variable-length information field 932' for other data transmissions, such as information  
4 on system updates. The frame format 920' ends with an 8-bit flag (or trailing flag) 934'  
5 that is identical in format to the leading flag 922', as set forth above. Other frame  
6 formats (e.g., MPEG) will be apparent to one skilled in the art and can be easily adapted  
7 for use with the system.

8           As summarized above, images or programs may be selected for display by  
9 sequencing through a series of menus. Figure 8 is an example of one possible structure  
10 for a series of menus. Generally, the sequence of menus is structured with an  
11 introductory menu, a home menu, various major menus and a multitude of submenus.  
12 The submenus can include promo menus and during program menus. For example, at the  
13 home menu portion of the sequence of menus and corresponding software routines, a  
14 subscriber may select one of the major menus and start a sequence of menu displays.  
15 Alternatively, a subscriber may go directly to a major menu by depressing a menu select  
16 button on remote control 900.

17           At any time during the menu sequence, the subscriber may depress a major menu  
18 button to move into another series of menus. In this way, a subscriber may move from  
19 major menu to major menu.

20           The various software subroutines executed by the microprocessor 602 allow a  
21 subscriber to sequence the menus, navigating through the various menus of the present  
22 invention. A subscriber may sequence back through menus or return to the home menu  
23 with a single touch of the home menu button on remote 900.

24           An introductory menu screen 1000 automatically appears upon power-up and  
25 initialization of the set top terminal 220. From this introductory menu screen 1000, the  
26 set top terminal software will normally advance the subscriber to the home menu screen  
27 1010. The home menu 1010 is the basic menu that the subscriber will return to in order  
28 to make the first level of viewing decisions. When the set top terminal software is  
29 displaying the home menu 1010, the subscriber is able to access any television

1 programming option. The software allows programming options to be entered through  
2 cursor movement on the screen and directly by button selection on the remote control  
3 900.

4 In the normal progression through the menu screens, the software will forward the  
5 subscriber to a major menu screen 1020 in response to the subscriber's remote control  
6 900 selection or highlighted cursor selection from the home menu screen 1010. The  
7 selections displayed on the home menu 1010 are for large categories of programming  
8 options.

9 Following the major menu 1020, the subscriber may navigate through one or more  
10 submenu screens 1050 from which the subscriber may choose one particular program for  
11 viewing. For most programming selections, the user will proceed from the home menu  
12 1010 to a major menu 1020 and then to one or more submenus 1050. However, for  
13 certain programming options or functions of the set top terminal 220, the user may skip  
14 one or more menus in the sequence.

15 The During Program Menus 1200 are submenus enabled by the set top terminal  
16 software only after the subscriber has selected a television program. These menus  
17 provide the subscriber with additional functionality and/or additional information while  
18 viewing a selected program. The During Program Menus 1200 sequence can be further  
19 subdivided into at least two types of menus, Hidden Menus 1380 and Program Overlay  
20 Menus 1390.

21 To avoid disturbing a subscriber during viewing of a program, the Hidden Menus  
22 1380 are not shown to the subscriber but instead "reside" at the set top terminal 220  
23 microprocessor 602. The microprocessor 602 awaits a button entry either from the  
24 remote control 900 or set top terminal 220 buttons before executing or displaying any  
25 Hidden Menu 1380 options. The set top terminal software provides the subscriber with  
26 additional functions such as entering an interactive mode or escaping from a selected  
27 program through use of Hidden Menus 1380.

28 Program Overlay Menus 1390 are similar to Hidden Menus 1380. However, the  
29 Program Overlay Menus 1390 are overlaid onto portions of the displayed video and not

1 hidden. The software for the Program Overlay Menus 1390 allows the subscriber to  
2 continue to watch the selected television program with audio but places graphical  
3 information on a portion of the television screen. Most Program Overlay Menus 1390  
4 are graphically generated to cover small portions of video. Some Overlays 1390 which  
5 are by their nature more important than the program being viewed will overlay onto  
6 greater portions of the video. Examples of types of overlay menus 1390 include  
7 Notification Menus 1392 and Confirmation Menus 1394. In the preferred embodiment,  
8 the software for the Program Overlay Menus 1390 controls the reduction or scales down  
9 the (entire) programs video and redirects the video to a portion of the screen.

10 Submenus provide the cost of viewing the program and the program's length in  
11 hours and minutes. From the submenus, the subscriber is given at least three options: (1)  
12 to purchase a program, (2) to return to the previous menu, and (3) to press "go" and return  
13 to regular TV. The subscriber may also be given other options such as previewing the  
14 program.

15 Using an on-screen menu approach to program selection, there is nearly an  
16 unlimited number of menus that can be shown to the subscriber. The memory capability  
17 of the set top terminal 220 and the quantity of information that is sent using the program  
18 control information signal are the only limits on the number of menus and amount of  
19 information that can be displayed to the subscriber. The approach of using a series of  
20 menus in a simple tree sequence is both easy for the subscriber to use and simply  
21 implemented by the set top terminal 220 and remote control device 900 with cursor  
22 movement. A user interface software programmer will find many obvious variations  
23 from the preferred embodiment described.

24 The set top terminal 220 generates and creates menus using, in part, information  
25 stored in its graphics memory. A background graphics file 800 will store menu  
26 backgrounds and a logo graphics file will store any necessary logos. A menu display and  
27 cursor graphics file will store menu display blocks and cursor highlight overlays as well  
28 as any other miscellaneous files needed to build the menus. Using this method of storing  
29 menus, the menus can be changed by reprogramming the graphics memory of the set top

1 terminal 220 through instructions from either the network controller 214 or operations  
2 center 202.

3 The microprocessor 602 performs the steps required to create a menu using stored  
4 information. The microprocessor 602 fetches a background file, logo file, menu display  
5 and cursor file in most instances. The microprocessor 602 fetches text from long-term,  
6 intermediate-term, or short-term storage depending on where the text is stored. Using a  
7 video combiner (or like device), the stored information is combined with video and the  
8 entire image is sent to the television screen for display.

9 In the preferred embodiment, a graphics controller is used to assist the set top  
10 terminal 220 in generating menus. Menu generation by the set top terminal 220 begins  
11 with the building of a major menu screen, which includes background graphics for that  
12 major menu. The background graphics may include an upper sash across the top of the  
13 screen and a lower sash across the bottom of the screen. The background graphics may  
14 be generated from the background graphics file 800 in the memory files of the graphics  
15 memory (preferably EEPROM). In addition, logo graphics may be generated. Such  
16 graphics typically include an icon window, a cable company logo, a channel company  
17 logo, and two "go" buttons.

18 Preferably, the text for each major menu is generated separately by a text  
19 generator in the set top terminal 220. Those portions of the text that generally remain the  
20 same for a period of weeks or months may be stored in EEPROM or other local storage.  
21 Text which changes on a regular basis, such as the movie titles (or other program  
22 selections), is transmitted to the set top terminal 220 by either the operations center 202  
23 or the network controller 214 of the cable headend 208. In this manner, the cable  
24 headend 208 may change the program selections available on any major menu 1020 by  
25 modifying the program control information signal sent by the operations center 202 and  
26 transmitting any changes using the STTCIS.

27 Day, date and time information are added to each major menu. This information  
28 is sent from the operations center 202, the cable headend 208 (signal processor 209 or

1 network controller 214), the uplink site, or generated by the set top terminal 220  
2 internally.

3 The creation and display of program description submenus is performed by the  
4 set top terminal 220 in a manner similar to that described above. Each submenu may be  
5 created in parts and combined before being sent to the television screen. Preferably,  
6 background graphics and upper and lower sashes are used. Likewise, a video window  
7 and half-strip window can be generated from information in storage on the EEPROM.

8 In addition to graphics and text, some submenus include windows that show  
9 video. Such video may be still or moving pictures. Still pictures may be stored in a  
10 compressed format (such as JPEG) at the set top terminal 220. Video stills may be  
11 transmitted by the operations center 202 through the program control information signal  
12 from time to time.

13 Moving video picture is obtained directly from a current video feed as described  
14 above. Depending on video window size, this may require manipulation of the video  
15 signal, including scaling down the size of the video and redirecting the video to the  
16 portion of the menu screen which is within the video window of the menu.  
17 Alternatively, the video may be obtained from a split screen channel. Such a method  
18 involves the use of split screen video techniques to send multiple video clips on a single  
19 channel at a given time. The set top terminal 220 would scale the picture, if necessary,  
20 and redirect it to the correct position on the screen using known scaling and positioning  
21 techniques. Additional circuitry may be required in the set top terminal 220 to perform  
22 adequate scaling and repositioning.

23 To avoid the need for redirecting video into the portion of the screen which  
24 houses the video window, masking and menu graphics may be used to cover the portions  
25 of the channel video that are not needed. This masking technique allows the split screen  
26 video to remain in the same portion of the screen that it is transmitted by the operations  
27 center 202. The masking is then adjusted to cover the undesired portions of the screen.  
28 These masks are stored in the background graphics file similarly to other background files  
29 for menus.

1           The split screen video technique may also be used for promoting television  
2 programming. Since a great number of short video clips may be sent continuously, full  
3 or partial screen promotionals (or informationals) may be provided to the subscriber.  
4 With this large quantity of promotional video, the subscriber is given the opportunity to  
5 "graze" through new movie or television programming selections. The subscriber simply  
6 grazes from promotional video to promotional video until the desired television program  
7 is discovered.

8           C.     Detailed Description of Advanced Set Top Terminal

9                     1.     Overview

10           The present invention relates to advances in the set top terminal 220 described  
11 above. In particular, the present invention may be achieved through a set of hardware  
12 upgrades or additions to the following embodiments: (1) an existing set top converter (not  
13 shown) upgraded with a Turbo Card 700 or the like; (2) an industry standard digital  
14 decompression converter box (as shown in Figures 9a and 9b below) ungradable by either  
15 an upgrade module or a menu generation card; (3) a set top terminal 200 capable of both  
16 decompression and menu generation; or (4) a digital television. The set of hardware  
17 upgrades described below can be used to provide additional advanced features and  
18 functional capabilities to any of these embodiments.

19           Table A shows several exemplary hardware configurations that may be used to  
20 achieve the goals of the present invention. In particular, Table A shows four columns of  
21 set top converter technology, which may be modified to produce the various set top  
22 capabilities shown in the three rows of the table.

TABLE A

/	<b>Existing Analog Set Top Converter</b>	<b>Set Top Converter With Digital Decompression</b>	<b>Set Top Converter With Digital Decompression &amp; Menu Generation Capabilities</b>	<b>Advanced Set Top Terminal</b>
/				
/				
/				
<b>Decompression Capability</b>	N/A	Built-In	Built-In	Built-In
<b>Menu Generation Capability</b>	Turbo Card	Upgrade Module or Menu Generation Card	Built-In	Built-In
<b>Advanced Features</b>	Level A-C Hardware Upgrades or Expansion Card	Level A-E Hardware Upgrades or Expansion Card	Level A-E Hardware Upgrades or Expansion Card	Built-In
/				
/				
/				

The table shows the various inherent functional capabilities of each set top converter, and how each may be modified or upgraded, if necessary, to achieve the objectives of the present invention. From left to right, the columns of the table span the various alternatives for balancing those capabilities that may be built into set top converters or terminals, on the one hand, and those capabilities that can be provided through, for example, an upgrade module, expansion card or hardware upgrade of the present invention, on the other. This balance allows a designer or manufacturer of set top converters to choose between adding advanced functionality to an existing converter box or, instead, producing a converter with additional built-in features that increase cost and complexity of the converter or terminal.

The first column of Table A shows how an existing analog set top converter can be modified to provide menu generation capability through the use of the Turbo Card. In addition to the Turbo Card, such an existing analog set top converter may be further modified to provide any of the advanced features described below through the use of the Level A, Level B and Level C hardware upgrades or an expansion card. Such existing set top converter boxes are currently manufactured by Scientific Atlanta and General



1 Instruments, among others. These converter boxes have been designed for use with  
2 analog waveforms and, as a result, digital decompression capabilities are not applicable.

3 The second column of Table A shows a set top converter with digital  
4 decompression capability. This converter is a simple decompression box which may  
5 eventually become the industry standard. The simple decompression boxes may be  
6 modified to provide the enhanced functionality of the present invention. For example,  
7 a simple decompression box may be modified to produce menu generation capability  
8 through the use of an upgrade module or menu generation card. In addition, other  
9 advanced features may be added to a simple decompression box through modifications  
10 that include any of the Level A through E hardware upgrades or an expansion card. Each  
11 of these modifications are described below.

12 The third column of Table A shows a set top converter that has built-in digital  
13 decompression and menu generation capabilities. Thus, in order to achieve the enhanced  
14 functionality of the present invention, other advanced features may be provided through  
15 hardware modification. Such modification may be accomplished through the use of any  
16 of the Level A through E hardware upgrades or the expansion card, as explained below.

17 The fourth column of Table A shows an advanced set top terminal having  
18 decompression, menu generation, and advanced functional capabilities. Each of these  
19 capabilities are built in to the terminal itself. In this way, achieving the enhanced  
20 performance of the set top terminal in accordance with the present invention would  
21 require no hardware modification.

22 In the preferred embodiment, the advanced set top terminal 220 of the present  
23 invention has the capability, among other things, of receiving tiered programming from  
24 the network controller. Tiered programming allows different users to view different  
25 video even though the subscribers are "tuned" to the same channel. For example, the  
26 network controller 214 may know the demographics of its subscribers through a database,  
27 by "learning" from prior subscriber choices, from an interactive selection, or from other  
28 means. Using the demographics information, the network controller 214 may target  
29 commercials to the correct audience by showing different commercials to subscribers

1 with different demographics. Even though subscribers will believe they are "tuned" to  
2 one channel, each subscriber will be switched to a different channel for the tiered video.  
3 Alternatively, subscribers may be offered an option of several commercials from which  
4 to choose.

5 To accommodate foreign speaking subscribers, multiple audio channels for  
6 television programming may be provided. In this way, the subscriber may be shown  
7 menus of programs available in the subscriber's native language. The function of  
8 choosing the correct audio to correspond to the selected language may be handled by  
9 either the set top terminal 220 or the network controller 214 depending upon the  
10 configuration. Local programming in several languages or additional audio channels for  
11 a foreign language translation of a popular television program may be provided by the  
12 network controller 214. Using a picture-on-picture feature, sign language may be  
13 similarly made available to certain set top terminals 220 for the deaf. Also, a text overlay  
14 may easily be produced on the lower part of the screen for the deaf.

15 Typically, each video signal is received at the set top terminal 220 along with four  
16 audio channels. Two of these audio channels will preferably be used for left and right  
17 stereo audio reception of the video signal being displayed. The remaining two audio  
18 signals may be used for alternative languages. For example, where a video signal is  
19 received by the set top terminal 220, two of the audio channels will provide the stereo  
20 audio signals for that video in English, with the other two audio channels providing mono  
21 audio signals in French and Spanish, for example. In this way, each video signal received  
22 at the set top terminal 220 can accommodate at least two foreign languages. Where  
23 stereo audio channels are not desired, the audio channels in English can be set to a single  
24 signal, providing mono audio reception, and increasing the multiple language audio  
25 channel capability to three foreign languages.

26 In other embodiments, the network controller 214 can act as a central computer  
27 and provide intra-set top terminal interactive games, inter-set top terminal interactive  
28 games, computer bulletin board type services, message services (Electronic mail) etc. For  
29 example, a subscriber may play war games with five (anonymous) fellow subscribers

1 each in their own home each operating a separate tank. The network controller 214  
2 gathers the players via set top terminal 220 communications and acts as the referee. A  
3 bulletin board or message system can be set up to discuss a particular program such as  
4 "Twin Peaks Whodunit" for enthusiasts. These interactive features are further described  
5 below with the interactive services level B menu and the set top terminal hardware  
6 upgrade level B interactive unit.

7 In order to achieve the required throughput of video and audio information for the  
8 system, digital compression techniques for video are employed. As a result, the set top  
9 terminal 220 typically must decompress any digitally compressed program signals that  
10 it receives. Methods of decompression are a function of the compression technique used  
11 in the program delivery system.

12 There are three basic digital compression techniques: within-frame (intraframe),  
13 frame-to-frame (interframe), and within-carrier compression. Various compression  
14 methods may be used with these techniques. Such methods of compression, which  
15 include vector quantization and discrete cosine transform methodologies, are known to  
16 those skilled in the art.

17 Several standard digital formats representing both digitizing standards and  
18 compression standards have also been developed. For example, JPEG (joint  
19 photographic experts group) is a standard for single picture digitization. Motion picture  
20 digitization may be represented by standards such as MPEG or MPEG 2 (motion picture  
21 engineering group specification). In addition to these standards, other proprietary  
22 standards have been developed. Although MPEG and MPEG 2 for motion pictures are  
23 preferred in the present invention, any reliable digital format with compression may be  
24 used.

25 Various hybrids of the above compression techniques and methods have been  
26 developed by several companies including AT&T, Compression Labs, Inc., General  
27 Instruments, Scientific-Atlanta, Philips, and Zenith. Any of the compression techniques  
28 developed by these companies, as well as other techniques known to those skilled in the  
29 art, may be used with the present invention.

1                                   2.       Advanced Set Top Terminal Major Components and Upgrades

2                                   a.       Decompression Box with Upgrade Module

3                   The preferred program delivery system uses digitally compressed signals and, as  
4                   a result, the preferred subscriber equipment configuration must be capable of  
5                   decompressing and processing such digitally compressed signals. Figure 9a diagrams the  
6                   basic interplay between an upgrade module 300 and a simple decompression box 302.  
7                   The upgrade module 300 can be connected to the decompression box 302 through a port  
8                   similar to the upgrade port 662 described above (Figure 5b). The simple decompression  
9                   box 302 shown is preferably a future industry standard decompression box capable of  
10                  communicating with an upgrade module 300 to enhance functionality.

11                 The upgrade module 300 provides menu generation capability to the simple  
12                 decompression box 302. The microprocessor of the simple decompression box 302  
13                 communicates with the microprocessor in the upgrade module 300 to provide the full  
14                 functionality of a set top terminal 220.

15                 In the preferred embodiment, multipin connections may be used for a multiwire  
16                 cable connecting the simple decompression box 302 with the upgrade module 300. The  
17                 multipin connection may range from DB9 to DB25. A SCSI, or small computer systems  
18                 interface, port (not shown) may also be provided. Alternatively, four or more ports may  
19                 be provided instead of the single port depicted. If a port is not provided, the upgrade  
20                 module may, alternatively, be hard-wired to the simple decompression box 302.

21                 As represented generally at 304, the digital data set of output wires of the simple  
22                 decompression box 302 will preferably output error corrected and decrypted data to the  
23                 upgrade module 300. The second set of wires, providing the interface connection, allows  
24                 the microprocessor in the upgrade module 300 to communicate with the microprocessor  
25                 of the simple decompression box 302. In this manner, the video circuitry of the upgrade  
26                 module 300 and the simple decompression box 302 may maintain synchronization. The  
27                 third set of wires, providing the decompressed video output, provide the upgrade module  
28                 300 with a decompressed video signal to manipulate. The fourth set of wires, comprising

1 the video input set, allows the simple decompression box 302 to accept a video signal that  
2 is a combined text, graphics, and video signal.

3 Figure 9a further shows the CATV input 306, video input 308, and video and  
4 audio outputs 310, 312, as part of the simple decompression box 302. This embodiment  
5 reduces the component cost of upgrade module 300, and thus, is preferred. The upgrade  
6 module 300 may simply be a cartridge (not shown) insertable into the simple  
7 decompression box 302. Alternatively, as shown in commonly numbered Figure 9b, the  
8 CATV input 306, video input 308 and video and audio outputs 310, 312 may be included  
9 as part of the upgrade module 300. In this embodiment, the simple decompression box  
10 302 is primarily used for decompressing the video.

11 Referring to Figure 10, the upgrade module 300 preferably includes the following  
12 circuitry: a video graphics and text demultiplexer 314; a text and graphics video plane  
13 combiner 316; a run length graphics decompressor 318; and, a run length compressed  
14 graphics memory 319 (nonvolatile RAM, ROM, EPROM, or EEPROM). By means of  
15 communications through the multiwire connection between the upgrade module 300 and  
16 the simple decompression box 302, compressed video and control signals may be  
17 demultiplexed by the demultiplexer 314 within the upgrade module 300. The run length  
18 graphics decompressor 318, through communications with the run length compressed  
19 graphics RAM 319, permits decompression of the input compressed video signal. The  
20 text and graphics video plane combiner 316 allows demultiplexed and decompressed  
21 signals to be output, through the simple decompression box 302, to a subscriber's  
22 television 222 showing both video and overlay menus with text.

23 Figure 10 shows the elements of a simple decompression box 302 (numbered  
24 commonly with the elements of the set top terminal 220 depicted in Figure 4) with the  
25 upgrade module 300 described above. Generated menus and video are combined in the  
26 combiner 316 and output to an antitaping encoder 619. Any method of antitaping  
27 encoding known by those skilled in the art may be used with the present invention.

1           Figure 10 also depicts an expansion card 320 and an expansion card interface 322  
2           for receiving the card 320. In addition, error correction circuitry 324 is shown receiving  
3           the demodulated signal, prior to demultiplexing the signal.

4           The enhanced functionality of the upgrade module 300 may alternatively be  
5           included on the expansion card 320. In this embodiment, the upgrade module 300  
6           becomes an internal component of the simple decompression box 302 and internally  
7           upgrades the box 302 to include menu generation capability without using an external  
8           hardware upgrade module 300. Other variations in the upgrade module 300 configuration  
9           are also possible.

10                                   b.     Upstream Data Transmission

11           Figure 11 shows a preferred set top terminal 220 that includes a data receiver 332  
12           and a data transmitter 344. The data transmitter 344 provides upstream data  
13           communications capability between the set top terminal 220 and the cable headend 208.  
14           Upstream data transmissions are accomplished using the polling system described with  
15           reference to Figures 7a and 7b above, and, in particular, using a data transmitter 344.  
16           Both receiver 332 and transmitter 344 may be built into the set top terminal 220 itself or  
17           added through an upgrade module 300. Regardless of the specific hardware  
18           configuration, the set top terminal's data transmission capabilities may be accomplished  
19           using the hardware shown in Figure 11.

20           Figure 11 shows RF signals, depicted at 330, being received at by a data receiver  
21           332 and tuner 603 working in unison. Both of these devices are interfaced with the  
22           microprocessor 602, which receives inputs, depicted at 338, from the subscriber, either  
23           through the set top terminal's keypad 645 or remote control unit 900. All cable signals  
24           intended for reception on the subscriber's TV are accessed by the tuner 603 and  
25           subsequently processed by the processing circuitry 340. This processing circuitry 340  
26           typically includes additional components for descrambling, demodulation, volume control  
27           and remodulation on a Channel 3 or 4 TV carrier.

1 Data targeted to individual set top terminals 220 is received by the data receiver  
2 332 according to each set top terminal's specific address or ID (e.g. set top ID 928, 928').  
3 In this way, each addressable set top terminal 220 only receives its own data. The data  
4 receiver 332 may receive set top terminal specific data in the information field of the  
5 program control information signal frame described with reference to Figure 7a or on a  
6 separate data carrier located at a convenient frequency in the incoming spectrum.

7 Any received data includes information regarding channels and programs  
8 available for selection. The subscriber may enter a series of commands using the keypad  
9 645 or remote control 900 in order to choose a channel or program. Upon receipt of such  
10 commands, the set top terminal's microprocessor 602 instructs the tuner 603 to tune to  
11 the proper frequency of the channel or program desired and subsequently instructs the  
12 processing circuitry 340 to begin descrambling of this channel or program.

13 Upon selection of a channel or program, the microprocessor 602 stores any  
14 selection information in local memory for later data transmission back to the cable  
15 headend 208. Typically, the data transmitter 344 operates in the return frequency band  
16 between 5 and 30 MHZ. In an alternative embodiment, the frequency band of 10 to 15  
17 MHZ may be used. Regardless, however, of the frequency band used, the data transmitter  
18 344 sends information to the cable headend 208 or network controller 214 in the  
19 information field of the frame described with reference to figure 7b. Those skilled in the  
20 art will recognize that a number of variations and combinations of the above-described  
21 set top terminal 220 hardware components may be used to accomplish upstream data  
22 transmissions.

23 c. Hardware Upgrades

24 In order to enhance a set top terminal's 220 functionality, the following hardware  
25 upgrades may be used: (1) a Level A interactive unit, (2) a Level B interactive unit, (3) a  
26 Level C interactive unit with compact disc capability, (4) a Level D digital radio tuner for  
27 separate room use, and (5) a Level E information download unit. Each of these upgrades  
28 is connected to the set top terminal 220 unit through the upgrade port 662 described  
29 earlier.

1           Level A, B and C hardware upgrades have similar hardware components. Figure  
2       12a diagrams the basic components of the Level A, B and C hardware upgrades, indicated  
3       generally at 100. The figure diagrams the interaction between the hardware upgrades 100  
4       and the set top terminal's 220 basic components. As seen in the figure, CATV input  
5       signals are received by the set top terminal 220 using a tuner 603 and various receiver  
6       components described above (but denoted generally at 601 in Figures 12a and 12b). The  
7       set top terminal's microprocessor coordinates all CATV signal reception and also  
8       interacts with various upstream data transmission components 604, which have been  
9       described above.

10           The Level A, B and C hardware upgrades 100 each include a microprocessor 104,  
11       interactive software 106, processing circuitry 108, bubble memory 112, and a long-term  
12       memory device 116. In addition to these basic components, the Level B hardware  
13       upgrade makes use of an additional telephone modem 120, while the Level C hardware  
14       upgrade makes use of an additional CD-ROM storage device 122.

15           Along with their basic components, the Level A, B and C hardware upgrades 100  
16       each use their own interactive software 106. This software may be used to provide the  
17       enhanced functional capabilities described below. The Level A, B and C hardware  
18       upgrades also make use of processing circuitry 108, which allows the set top terminal 220  
19       to pass the subscriber's interactive input to the Level A, B and C hardware upgrades 100  
20       for interpretation. These commands are passed through the interface linking the set top  
21       terminal's microprocessor with the microprocessor of the Level A, B and C hardware  
22       upgrades 100. In this way, subscriber inputs, entered through the set top terminal keypad  
23       or remote control, can be transferred to any of the hardware upgrades for processing and  
24       responses generated therein can then be sent back to the set top terminal 220 for display.  
25       In the preferred embodiment the IR commands are transferred from set top terminal to  
26       hardware upgrade.

27           The Level A, B and C hardware upgrades 100 also include a long-term memory  
28       component or device 116 that allows each hardware upgrade to internally store data used  
29       with each interactive service. Such data may include, for example, customized menu



1 templates used by the individual interactive services. In addition, the Level A, B and C  
2 hardware upgrades include a bubble memory 112 for the temporary storage of, for  
3 example, interactive questions and responses used in each particular interactive service.

4 The Level A interactive unit allows the subscriber to access interactive services  
5 offering additional information about programs such as quizzes, geographical facts, etc.  
6 This information may be received by the set top terminal 220 in several data formats,  
7 including using the vertical blanking interval (VBI) or the program control information  
8 signal. The Level A interactive unit enables the subscriber to engage in textual  
9 interactivity with the current television program using overlay menus. Some examples  
10 are quizzes, fast facts, more info, where in the world, products, etc, all of which provide  
11 the subscriber with an interactive question and answer capability. Although the Level A  
12 interactive capability can easily be built into the set top terminal 220, such an  
13 embodiment increases the cost of the basic set top terminal 220.

14 The Level B interactive unit provides the user with access to online data base  
15 services for applications such as home shopping, airline reservations, news, financial  
16 services, classified advertising, home banking, and interactive teletext services. For  
17 example, with this upgrade, a user will be able to reserve plane tickets or buy consumer  
18 electronics. The primary feature of this upgrade unit is that it allows actual transactions  
19 using two-way communications over modem with outside services. This added two-way  
20 communications capability may be with the cable headend 208 or, alternatively, over  
21 cellular networks, PCN or other communications media.

22 The Level C interactive unit employs a high volume local storage capacity,  
23 including compact disc or other random access digital data formats (e.g., CD-ROM 122).  
24 This unit allows use of interactive multi-media applications. Such applications include,  
25 for example, computer games, multi-media educational software, encyclopedias, other  
26 reference volumes (e.g. Shakespeare library), etc. In the preferred embodiment, many of  
27 these applications will interact with live programming providing additional information  
28 and interactivity to the basic program feed. For example, a viewer watching a show set  
29 in a foreign country may be able to retrieve additional information, maps, economic data,

1 as well as other information about that country that are stored on the compact disc. In the  
2 Level C applications, the upgrade hardware may closely monitor the television broadcast  
3 through additional data channels (e.g., vertical blanking interval, or other digital data  
4 encoded within live video) providing context sensitive interactivity.

5 Figure 12b diagrams the interaction between the set top terminal 220 and the  
6 Level D hardware upgrade, indicated generally at 130. As shown in the figure, the CATV  
7 signals are input to the set top terminal 220 through its tuner 603 and receiver  
8 components 601. As described above, the microprocessor 602 coordinates all cable  
9 television signal reception by the set top terminal 220. The Level D hardware upgrade  
10 130 makes use of a microprocessor 132, a tuner 134, a demodulator 136, a demultiplexer  
11 138, a decryptor 140 and an audio decompressor 142.

12 As shown in the figure, the set top terminal 220 and the Level D hardware  
13 upgrade 130 interact through the interface linking the respective devices. The set top  
14 terminal's microprocessor 602 instructs received signals to be transferred to the Level D  
15 hardware upgrade 130 for further processing. These received signals are input to the  
16 Level D hardware upgrade, passed through the signal path comprising the tuner 134 and  
17 other digital audio reception components (i.e., demodulator 136, demultiplexer 138,  
18 decryptor 140 and audio decompressor 142). Through the use of the hardware as  
19 configured in Figure 12b, the subscriber can select a digital audio program for listening.  
20 The subscriber can accomplish such selection through a subscriber interface (not shown),  
21 which may exist at the set top terminal 220 or, alternatively, at the Level D hardware  
22 upgrade.

23 The Level D hardware upgrade allows the subscriber separate access to the digital  
24 radio channels while other programming (not necessarily radio) is being viewed on the  
25 television. Typically, this upgrade would be used for digital radio usage in a separate  
26 room from that of the television. The upgrade has a separate tuner, decompressor, and  
27 visual display. In the preferred embodiment a second remote control (which is preferably  
28 a scaled-down version of the set top terminal remote control, described below) is  
29 provided to access the digital audio system. This remote is equipped with a display.

1           The Level E hardware upgrade allows the subscriber to download large volumes  
2 of information from the operations center 202 or cable headend 208. The Level E  
3 hardware upgrade will enable subscribers to download data, such as books and  
4 magazines, to local storage. Primarily, the Level E hardware upgrade is an additional  
5 local storage unit (e.g., hard disk, floppy, optical disk or magnetic cartridge). Preferably,  
6 a small portable reader, called "EveryBook™", is also provided with the upgrade to  
7 enable downloaded text to be read without the use of a TV. The portable reader is  
8 equipped with a screen.

9           The downloadable information may be text or video supplied by the operations  
10 center 202 or cable headend 208. With this upgrade, books may be downloaded and read  
11 anywhere with the portable reader. Using this upgrade, video may be downloaded and  
12 stored in compressed form for later decompression. The video would be decompressed  
13 only at the time of viewing. Important text that the public desires immediate access may  
14 made available through this system. Text such as the President's speech, a new law, or  
15 a recent abortion decision rendered by the Supreme Court may be made immediately  
16 available.

17           Using a more sophisticated port, such as the SCSI port, multiple hardware  
18 upgrade units may be connected, or "daisy-chained" together, to operate simultaneously.  
19 Although these upgrade units are described separately, the units may be combined or built  
20 into the set top terminal 220. Those skilled in the art will recognize variations on such  
21 combinations of and additions to the set top terminal hardware.

22                           d.    Expansion Card Slot

23           In order to provide the greatest flexibility possible and prevent a set top terminal  
24 220 from becoming outdated during the terminal's useful life, additional electronic  
25 expansion card slots have been built into the preferred embodiment. The expansion slots  
26 665 (depicted in phantom in Figure 5b) are covered by the metal plate cover 664 as  
27 shown in Figure 5b. It is anticipated that additional memory or capabilities may be  
28 needed for certain customer features and also to update the system as the cable delivery  
29 system's capabilities increase.

1 In addition to providing an additional memory capability, the expansion card slot  
2 provides an easy method to upgrade the set top terminal hardware. In particular,  
3 expansion cards can be used to internally provide any of the Level A through E hardware  
4 upgrade features described above. Such embodiments, however, use the upstream data  
5 transmission hardware, also described above (or built-in modem).

6 Functionally, the expansion card (not shown) may be inserted into an expansion  
7 card slot 665, causing the connector on the expansion card to electrically link with a  
8 connector on the set top terminal 220. Preferably, the frame of the set top terminal has  
9 a shelf or rack position to hold the expansion card. The connector on the set top terminal  
10 220 may simply be an electrical connection to the set top terminal's microprocessor  
11 and/or memory device or devices. Alternatively, the interface between the expansion  
12 card and the set top terminal 220 may be an electrical bus that allows the memory  
13 resources of the set top terminal 220 to be directly expanded. In this case, the expansion  
14 card itself contains a memory device or devices that expand the amount of program  
15 information or data that the set top terminal 220 may access. Such memory devices  
16 include RAM, ROM, EPROM or EEPROM. In addition, the interface may be a  
17 "mailbox," which resides in the set top terminal 220 as a single memory location. This  
18 embodiment facilitates the transfer of data between the set top terminal 220 and the  
19 expansion card in either serial or parallel format. Such transfers are coordinated and  
20 controlled by the set top terminal's microprocessor 602.

21 The use of expansion cards lowers the cost of the set top terminal 220 itself, while  
22 also increasing its potential functionality. Thus, an expansion card may include enhanced  
23 functional capabilities described as part of the upgrade module discussion above and be  
24 designed to accommodate any hardware upgrade compatible with the set top terminal  
25 220.

### 26 3. Remote Control and Subscriber Access of Set Top Terminal

27 The subscriber can access programs televised by the system through the set top  
28 terminal 220 using a remote control 900. Figure 13a shows a two-section remote control

1 900 that accommodates such access. To reduce costs and make the set top terminal 220  
2 as user friendly as possible, a standard television remote control 350, such as a Jerrold  
3 RC 650 remote control or the like, may be augmented by adding a new section 352 that  
4 provides the additional digital menu access and ordering functions. Figure 13a depicts  
5 the addition of menu access and cursor movement control to the remote control 900.

6 The remote control 900 has an ordering button 354 and four-way cursor  
7 movement 356 that includes a "go" button 358 and menu access buttons 360. The  
8 preferred remote control 900 operates using infrared (IR) signals, with the signals being  
9 received by the infrared (IR) sensor 630 on the front of the set top terminal 220.

10 In the simplest embodiment, the remote 900, may be built with only cursor  
11 movement and a go button. In more sophisticated embodiments, the remote control 900  
12 may be provided with buttons that are programmable to perform specific functions for  
13 a series of entries. An intelligent or smart remote control 900 would increase both the  
14 cost and capability of the set top terminal 220 system. Using the augmented remote  
15 control 900 depicted in Figure 13a, a subscriber can navigate the program menu system  
16 of the set top terminal 220.

17 Figure 13b shows an alternative and preferred embodiment of the remote control  
18 900 for use in the present invention. Standard television receiver remote control switches  
19 or buttons 362 may be used, including volume control, channel select, power and signal  
20 source buttons, as well as other menu buttons 364, including cursor movement, cursor  
21 select, menu select, and pay television buttons arranged longitudinally on the remote  
22 control 900, as opposed to the width-wise separation, as shown in Figure 13a. The color  
23 of the buttons or the surrounding background may differ between the standard television  
24 remote control buttons 362 and the menu buttons 264 to differentiate visually between  
25 these two groups of buttons.

26 The width and depth of the remote control unit 900 are considerably less than the  
27 length to allow the remote control unit 900 to fit easily within a user's palm. The remote  
28 control unit 900 preferably has its center of mass balanced substantially near the  
29 longitudinal middle. This balance allows a user's thumb to naturally be placed in

1 substantially the middle portion of the remote control unit 900, when it is picked up by  
2 a user.

3 Since the center of mass of the remote control unit 900 is placed substantially near  
4 the longitudinal middle of the remote control unit 900 (thereby having a user's thumb  
5 naturally fall in this same center region), the standard remote buttons 362 and menu  
6 access switches or buttons 364 most frequently accessed and depressed by a user are  
7 placed in the central region of the remote control unit 900 within easy reach of the user's  
8 thumb. Channel and volume increment and decrement buttons 366 are placed near this  
9 center of mass and longitudinal center line. The channel buttons 366 are preferably  
10 beveled in opposing directions to allow a user to feel for and press a desired button  
11 without looking down at remote 900. Similarly, the volume buttons 368 are preferably  
12 beveled in opposing directions for the same reason. Additionally, the channel buttons  
13 366 could have a surface texture different from those of the volume buttons 368 to allow  
14 even easier differentiation.

15 Also placed in the longitudinal center, within easy reach of a user's thumb, are  
16 cursor movement buttons 370 and a "go" button 372. The "go" button 372 selects an  
17 option corresponding to the placement of the cursor. As opposed to buttons, a joystick  
18 may be used with a selection on the stick, or a trackball, depressible for selecting a  
19 desired choice. The cursor buttons 370 are placed ninety degrees apart, with the "go"  
20 button 372 placed within the center of the cursor movement buttons 370, as shown in  
21 Figure 13b. The cursor movement buttons 370 are preferably beveled inwardly toward  
22 the "go" button 372 and the "go" button 372 is recessed below the level of the cursor  
23 movement buttons 370 so that it is not accidentally pressed while depressing the cursor  
24 movement buttons 370. In addition to the beveling on the cursor movement buttons 370,  
25 these buttons may also have a surface texture to allow a user to feel for and select the  
26 appropriate button without looking down at the remote 900 and directional arrows could  
27 be raised or recessed on the surface of the cursor movement buttons 370 for this same  
28 purpose.

1           Menu select buttons 374 are placed near buttons 370 as shown in Figure 13b.  
2           Menu select buttons 374 are preferably the largest buttons on the remote control unit 900.  
3           Menu select buttons 374 preferably have icons or other graphics imprinted on their top  
4           surface or adjacent to corresponding buttons. For example, a button for the sports major  
5           menu may contain a baseball icon. The icons represent the programming available on the  
6           particular major menu selected by the menu select buttons 374. The icons may also be  
7           raised above the level of the menu select buttons to provide a textured surface. This  
8           textured surface would allow a user to select an appropriate menu button 374 by feel,  
9           without looking at the remote control unit 900. The icons would require substantial  
10          differences in texture, while still providing a meaningful graphic related to the associated  
11          menu.

12           As shown in Figure 13b, labels and icons are provided for the following major  
13          menus: movies, sports, children's programming, documentary/news, entertainment,  
14          magazines, programming guide, HDTV (high definition television), interactive TV,  
15          music, and an additional button 376 for further programming. Menu select buttons 374  
16          may also be labeled A through J for the above programs, with the last button for all  
17          additional major menus labeled K-Z.

18           Although the remote control unit 900 is described with a variety of channel  
19          selection buttons, nearly all buttons from a standard remote control (section 362 buttons)  
20          could be eliminated. The present invention would allow a subscriber to use a remote  
21          control unit 900 containing only menu select buttons 374 and/or cursor movement and  
22          select buttons, 370, 374, respectively.

23           As used herein, "button" is contemplated to include all manner of switches or  
24          touch sensitive circuitry to activate a particular function in the remote control unit 900.  
25          Additionally, although the remote control unit 900 communicates with the set top box by  
26          means of infrared transmission, other forms of communication are contemplated,  
27          including ultra-sound, radio frequency and other electromagnetic frequency  
28          communication.

1                   4.     Advanced Features and Functional Capabilities

2                             a.     Overview

3             In the preferred embodiment, the set top terminal 220 will include features that  
4     are now being adopted in the industry, including parental controls and locks, electronic  
5     diagnostics and error detection, muting, on-screen volume control, sleep timer, recall of  
6     last selection, etc. Each of these features has a corresponding menu (or overlay menu)  
7     that allows on-screen customizing and activation of the feature.

8             The preferred set top terminal 220 also supports a number of advanced features  
9     and functional capabilities. This set top terminal 220 provides subscribers with a picture-  
10    on-picture capability without requiring a special television to support the capability. The  
11    set top terminal 220 also supports a program catalogue service, which provides  
12    subscribers with information on all programming available at its particular subscriber  
13    location. The set top terminal 220 further includes the capability of querying viewers to  
14    establish, among other things, favorite channel lists, personal profile data and mood  
15    information. The set top terminal 220 allows the subscriber to view promotional menus  
16    on future programming events.

17            The set top terminal 220 supports additional capabilities using its hardware  
18    upgrades that allow subscribers to use other interactive services, for example, to engage  
19    in on-line question and answer sessions, to order and confirm airline tickets, and to access  
20    a variety of other data services. The set top terminal 220 makes use of a digital tuner as  
21    a hardware upgrade to provide subscribers with a digital audio capability.

22            The preferred set top terminal 220 may be used to control video tape machines,  
23    thereby simplifying the recording of programs. The set top terminal 220 can, in  
24    conjunction with the program delivery system, easily support high definition television  
25    (HDTV). For subscribers living in remote locations, the set top terminal 220  
26    accommodates backyard satellite systems.

27            In addition to all the features that the set top terminal 220 supports with its current  
28    internal programming and upgrade ability, additional features may be added or existing  
29    features increased through remote reprogramming of the set top terminal 220. Utilizing



1 the resident operating system on the read only memory (ROM), the cable headend 208  
2 is able to reprogram the random access memory (RAM) of the set top terminal 220. With  
3 this capability, the cable headend 208 can remotely upgrade software on the set top  
4 terminals 220.

5 Reprogramming will occur by using the program control information signal, with  
6 the appropriate signals sent over this signal. In an alternative embodiment, one channel  
7 is dedicated for the special programming needs. When reprogramming is to occur, the  
8 cable head end will send an interruption sequence on the program control information  
9 channel that informs the set top terminal 220 that reprogramming information is to  
10 follow.

11 b. Picture-On-Picture Capability

12 Although the preferred embodiment of the present invention decompresses one  
13 channel at a time for the viewer, users who desire a picture-on-picture capability can be  
14 provided with a set top terminal 220 having upgraded hardware components that allow  
15 two or more channels to be tuned and decompressed at any given time. Once two signals  
16 are available, the picture-on-picture capability can be made fully available in the set top  
17 terminal 220, without requiring a special television or a VCR.

18 Figure 14 diagrams one embodiment for implementing the picture-on-picture  
19 capability. Such implementation necessarily requires the use of two tuners 603, 603' and  
20 two decompressors 618, 618' so that two separate video programs may be displayed  
21 simultaneously on the subscriber's television screen. As shown in the figure, the CATV  
22 input signal is received by the set top terminal 220 and input into two separate tuners.  
23 These tuners will each tune to a separate television program, both of which will be  
24 simultaneously displayed on the subscriber's television. The two television programs are  
25 extracted from the CATV input signal by the two parallel signals paths depicted in Figure  
26 14.

27 Each signal path is substantially identical (therefore the components thereof are  
28 commonly numbered, with callout numbers of the components of one path carrying the  
29 prime indicator) and thus, only one path will be described. Each signal path shown

1 includes a tuner 603, a demodulator 606, a demultiplexor 609, a decryptor 600 and  
2 various decompression devices. As the respective signals pass through these devices, the  
3 microprocessor 602 coordinates the signal processing to produce a decrypted program  
4 signal. The decrypted program signal is further partitioned between audio, on the one  
5 hand, and video, graphics and text, on the other. The audio signals extracted are passed  
6 to an audio decompressor 612, which further processes the audio for output to the  
7 subscriber's television.

8 The embodiment diagramed in Figure 14 shows only single audio channels for  
9 each video channel tuned by the individual tuners. As described above, the number of  
10 audio channels will typically include four audio signals corresponding to a single video  
11 channel. At least two of these audio signals may be used for stereo television play.  
12 Although the subscriber can view two separate video pictures simultaneously through the  
13 picture-on-picture capability, the subscriber's television can only accommodate a single  
14 audio signal at a time (or two audio signals for stereo audio reception). Thus, the set top  
15 terminal hardware shown in Figure 14 must also include a switch (not shown), which  
16 accommodates the simple switching between each audio signal or signals that correspond  
17 to one video picture or another. Such an audio switch, which is a component well known  
18 in the art, allows the subscriber to listen to the audio of one picture or the other. The  
19 switch may be activated by operation of the remote control 900. The video, graphics and  
20 text portion of the program signal are routed through another demultiplexor 314, which,  
21 in turn, separates all video, graphics and text of the signals. These signal parts are stored  
22 in a memory device 620 within the set top terminal 220. This memory device may be a  
23 ROM, RAM, EPROM, or EEPROM.

24 The microprocessor 602 initiates and coordinates further decompression of the  
25 video, graphics and text for each of the program signals. Once these signal parts are  
26 decompressed within the set top terminal 220, these components are passed to a video  
27 combiner 316. The video combiner correlates and combines the video, graphics and text  
28 of the two program signals. The video combiner outputs these two signals for display on  
29 the subscriber's television. These signals may also pass through an NTSC encoder 625

1 to produce analog NTSC video waveforms, which may likewise be displayed on the  
2 subscriber's television. Such display necessarily requires that each signal pass through  
3 an RF modulator 605 in order to be input into a television. In this way, two separate RF  
4 video outputs are produced. Each video signal produced by the RF modulators has its  
5 own corresponding audio outputs produced by each audio decompressor.

6 Each video signal (and its corresponding audio signal) produced by the two tuner  
7 configuration can be simultaneously displayed on the subscriber's television, which has  
8 a picture-on-picture capability, or, alternatively, the set top terminal 220 itself can create  
9 the picture-on-picture image for display. Such display involves the scaling and  
10 repositioning of one or more of the video (and audio) signals so that both pictures  
11 produced can be viewed simultaneously. In so doing, the subscriber's television can  
12 display one of the pictures as a full screen display, with the other picture being displayed  
13 as a scaled and repositioned display overlayed on the full screen display. Alternatively,  
14 the pictures may be displayed in a side-by-side or split screen format. To implement such  
15 a technique, the set top terminal 220 must include the hardware components necessary  
16 to produce a picture-on-picture capability, including hardware capable of scaling,  
17 repositioning and overlaying images. Such an advanced set top terminal 220 allows the  
18 subscriber to make use of a picture-on-picture capability even though the subscriber's  
19 television cannot alone produce such a result.

20 Because digital programming may be provided in a multiplexed signal, a single  
21 tuner can also be used to provide picture-on-picture features. That is, the signal  
22 processing equipment associated with one of the multiple tuners in the set top terminal  
23 220 can demultiplex programming that has been multiplexed into a specified frequency  
24 band at the operations center 204, for example. The demultiplexed programs may then  
25 be scaled and repositioned for display on the television. Thus, a subscriber could view  
26 four movie videos simultaneously if the movies were bundled together as they might be  
27 for a premium movie service such as HBO.

c. Program Catalogue Service

Referring to Figure 15 and to Figure 8, in the preferred embodiment of the present invention, program catalogue menu 1100 listing programs available on network schedules, will be available as a major menu of the type shown as 1020. In the preferred embodiment, the major program catalogue menu 1100 would offer submenus, such as network schedules for the next seven days, today's network schedules for the next six hours, and TV program catalogue picks for the next seven days.

In order for the set top terminal 220 to provide a program catalogue service, the set top terminal 220 must receive information on all programming available at its particular subscriber location. This information will be sent to each set top terminal 220 as part of the program control information signal or STTCIS. The program control information signal would include, among other things, all programming scheduled for the next 7 days. This programming information would, for example, include the name of each program, the type of program, the program start time, the length of the program, the date the program will be shown, a brief description of the program and whether or not the program is closed-captioned, among other information.

All programming information sent to the set top terminal 220 for use with the program catalogue service will be stored in the set top terminal's internal memory. Upon selection of the program catalogue service by the subscriber, the microprocessor accesses the memory device during its menu generation and creation process. In this way, the programming information will be combined with the program catalogue menu or submenu template to produce the Program catalogue service. The program catalogue service may involve the use of more than one menu, especially where the network scheduling information covers time frames longer than a few days.

If the particular set top terminal 220 has been subscribed to the program catalogue service, the subscriber may proceed to a submenu showing schedules of programs. If the subscriber chooses the network schedule submenu 1102, he is offered a list of network schedules to choose from. If a subscriber were to choose, for instance, HBO, an HBO-

1 specific submenu (not shown) would appear and allow a subscriber to choose a date of  
2 interest to see what programs are available on that particular date.

3 d. Querying Viewer

4 To support a variety of services, the set top terminal 220 is capable of querying  
5 the viewer and recording viewer responses. For example, in order for the set top terminal  
6 220 to establish a favorite channel list as shown at 1100 in Figure 16a depicting the  
7 broadcast TV menu 1112, menus querying the subscriber and allowing the subscriber to  
8 input his selection of eight favorite channels is displayed.

9 After querying the subscriber for a list of popular shows the terminal displays a  
10 submenu allowing the subscriber to choose one of the subscriber's favorite or popular  
11 shows for viewing. Although various embodiments of menus are possible, the goals of  
12 each are the same -- to eliminate or augment printed guides to television programs. In  
13 an alternative embodiment, a program viewing suggestion feature is available as an  
14 additional feature. This feature gives the indecisive or lazy viewer suggestions as to  
15 which programs the viewer should watch. The set top terminal 220 uses a matching  
16 algorithm to accomplish this program suggestion feature. This program suggestion  
17 feature is described in detail in co-pending patent application Serial No. 08/160,281, U.S.  
18 Patent No. 5,798,785, entitled, REPROGRAMMABLE TERMINAL FOR  
19 SUGGESTING PROGRAMS OFFERED ON A TELEVISION PROGRAM DELIVERY  
20 SYSTEM, incorporated herein by reference.

21 In order for the set top terminal 220 to make decisions on which programs the  
22 subscriber should watch, the terminal must create a personal profile for the particular  
23 viewer. From the data in the particular viewer's personal profile and the television  
24 program information available in the program control information signal, the set top  
25 terminal 220 is able to select a group of programs which the particular viewer is most  
26 likely to watch.

27 In order for this feature to operate, a personal profile for each viewer can be  
28 gathered by the set top terminal 220 and stored in a memory file. The personal profile  
29 consists of demographic information that may be gathered in a number of ways. The set

1 top terminal 220 builds the personal profile for each viewer and stores the information  
2 in a memory file by viewer name. To build a personal profile in the preferred system, the  
3 viewer answers a series of questions presented on a series of menu screens. These  
4 personal profile screens request the viewer to input information such as name, sex, age,  
5 place of birth, place of lower school education, employment type, level of education,  
6 amount of television program viewing per week, and the number of shows in particular  
7 categories that the viewer watches in a given week such as, sports, movies,  
8 documentaries, sitcoms, etc. Any demographic information which will assist the set top  
9 terminal 220 in targeting advertisements to the viewer or suggesting programs may be  
10 used.

11 Once a personal profile has been created (in a particular set top terminal 220), it  
12 can be indefinitely stored in nonvolatile memory. A selection at the home menu screen  
13 1010 (Figure 8) activates the program selection feature. Following activation of the  
14 feature, the set top terminal 220 will present the viewer with a series of brief questions  
15 to determine the viewer's mood at that particular time, as shown in Figure 16b. For  
16 example, the first mood question screen 1114 may ask the viewer to select whether the  
17 viewer desires a short (30 minute), medium (30-60 minute), or long (60 plus minute)  
18 program selection. The second mood question screen 1116 requests the viewer to select  
19 between a serious program, a thoughtful program, or a light program, as shown in Figure  
20 16c. And the third mood question screen 1118 requests whether the user desires a  
21 passive program or an active program, as shown in Figure 16d. The viewer makes a  
22 selection in each question menu, utilizing the cursor movement keys and "go" button on  
23 the remote control unit 900.

24 After the viewer has responded to the mood question menus which determine his  
25 mood, the set top terminal 220 uses the personal profile information and mood  
26 information to find the best programming matches for the viewer. The set top terminal  
27 220 displays an offering of several suggested programs to the viewer. With this program  
28 selection feature, the set top terminal 220 can intelligently assist the specific viewer in  
29 selecting a television program.

1           The personal profile information may also be used in targeting advertisements.  
2       In the preferred embodiment, the network controller 214 can target specific  
3       advertisements to individual cable distribution network nodes or, alternatively, to  
4       individual subscribers. In order to accomplish the advertisement targeting capability, the  
5       network controller 214 transmits packages of advertisements to the cable distribution  
6       network nodes or subscribers for eventual display on the set top terminal 220. When the  
7       video that the subscriber is watching nears a break for a commercial, a specific  
8       advertisement or set of advertisements is specifically targeted to a particular set top  
9       terminal 220 based on the personal profile information described above. Although the  
10      network controller 214 is the component in the program delivery system which provides  
11      this targeting capability, the set top terminal 220 accommodates transparent channel  
12      switches to display the targeted advertisement. In this way, although the subscriber  
13      thinks that the set top terminal 220 is tuned to a specific channel, an advertisement from  
14      another channel is displayed on the subscriber's television.

15           The hardware required to accommodate such transparent channel switching  
16      capabilities are shown in Figures 17a and 17b. Figure 17a shows the set top terminal  
17      hardware components which accommodate channel switching within a single 6 MHZ  
18      channel bandwidth. These components include a tuner 603, a demodulator 606, a  
19      demultiplexer 609, a multiplexer 400, a decompressor 622, a microprocessor 602, and  
20      local memory M. The tuner 603 operates by tuning to a specific 6 MHZ bandwidth  
21      which includes the displayed video and a number of channels carrying advertisements.  
22      The demodulator 606 processes these signals and sends them to the demultiplexor 609,  
23      which converts the received signal into separate program and advertisement signals.  
24      During this processing, the microprocessor 602 coordinates the demultiplexing of the  
25      programming signals. Once the video signal pauses for a commercial break, the  
26      microprocessor 602 instructs the multiplexer 400 to select the advertisement or  
27      advertisements for decompression and subsequent display on the subscriber's television.  
28      This hardware configuration allows the set top terminal 220 to switch between channels

1 within the 6 MHZ bandwidth and display various advertisements for viewing, regardless  
2 of the video currently being watched by the subscriber.

3 Where a targeted advertisement falls outside the tuned 6 MHZ bandwidth  
4 containing the video that the subscriber is currently watching, the hardware configuration  
5 shown in Figure 17b is used. In this configuration, the microprocessor 602 instructs the  
6 tuner 603 to retune to another 6 MHZ channel bandwidth, as represented by bi-directional  
7 arrow A.

8 Working together, the microprocessor 602 and tuner 603 allow targeted  
9 advertisements, which have been transmitted in another 6 MHZ bandwidth, to be tuned  
10 with minimal acquisition time and delay. In particular, this configuration allows the set  
11 top terminal 220 to tune outside a given 6 MHZ bandwidth (to another 6 MHZ  
12 bandwidth) in order to select a targeted advertisement for display. This alternative  
13 embodiment may require the use of a full screen mask in order to minimize any annoying  
14 screen rolling during the tuning process. The masking is intended to cover any glitches  
15 which would otherwise be displayed during the acquisition time (e.g., 0.5 seconds) for  
16 retuning to another 6 MHZ channel bandwidth.

17 Where the acquisition time or delay becomes unreasonable, an alternative  
18 embodiment (not depicted) can include the use of two tuners similar to the configuration  
19 used above for the picture-on-picture capability. This alternative configuration using two  
20 tuners trades an increased cost for lower acquisition times. Those skilled in the art will  
21 recognize a number of other configurations of set top terminal hardware that will  
22 accommodate a transparent channel switching feature. A more detailed description of  
23 target advertising and channel switching is provided in patent application Serial No.  
24 08/160,280, U.S. Patent No. 5,600,364, entitled, NETWORK CONTROLLER FOR  
25 CABLE TELEVISION DELIVERY SYSTEM, incorporated herein by reference.

26 e. Promotional Menus

27 Figure 18 depicts the use of a promotional menu 1120 used to sell subscriptions  
28 to services in the system 200. This promotional menu is tailored to Level B interactive  
29 services which include a variety of on-line type services such as Prodigy, Yellow Pages,



1 Airline Reservations, etc. A similar menu is used for Level A interactive services that  
2 offers subscribers additional information about programs such as quizzes, geographical  
3 facts, etc. Such information may be received by the set top terminal 220 in several data  
4 formats, including in the vertical blanking interval (VBI) and in the program control  
5 information signal.

6 Other promotion menus similar to menu 1120 may be used for the Level C  
7 interactive services. The Level C interactive services utilize local storage such as CD  
8 technology (e.g., 122) to offer an enormous range of multi-media experiences. The Level  
9 C interactive services require a hardware upgrade as described earlier. Specially adopted  
10 CD-I and CD-ROM 122 units are used for this service.

11 Typically, promotional menus may be generated when a subscriber selects a  
12 nonexistent channel, creating a virtual channel. Such virtual channels do not require any  
13 additional bandwidth since these channels do not carry any of the data required to create  
14 a promotional menu. Instead, when the subscriber selects a channel that does not exist  
15 (e.g., Channel 166), a virtual channel is created using data sent to the set top terminal in  
16 a number of ways. For example, the data may be sent in the vertical blanking interval  
17 (VBI) of another channel, out-of-band, or with the menu information sent from the  
18 headend 208 in the set top terminal control information stream (STTCIS). The data will  
19 be used to create graphics stored locally at the set top terminal 220 as an NTSC video  
20 signal which may be displayed on the subscriber's television. In this way, a promotional  
21 menu may be drawn and a virtual channel is created. This capability simply provides the  
22 set top terminal 220 with the ability to display a promotional menu or graphics display  
23 whenever a nonexistent channel is selected by the subscriber.

24 f. Other Interactive Services

25 Figures 19a and 19b show menus (1130 and 1132, respectively) that are available  
26 using the interactive Level A services. Referring to Figure 19a, when interactive Levels  
27 A services are available for a television program, the system will display an interactive  
28 logo 1134 consisting of the letter "I" and two arrows with semicircular tails. In the  
29 preferred embodiment, the set top terminal 220 will place the interactive logo on the

1 television screen as an overlay menu. In the preferred embodiment, the set top terminal  
2 220 will detect that there is data or information available about a television program  
3 which can be displayed to a subscriber using the interactive service. When the set top  
4 terminal 220 senses that there is interactive information available, it will generate the  
5 interactive logo overlay menu 1134 and place it on the television screen. For example,  
6 the set top terminal 220 will detect that information on a television program is being sent  
7 in the vertical blanking interval (VBI) and generate an interactive logo overlay menu  
8 1134 which will appear on the subscriber's television screen for approximately fifteen  
9 seconds during each ten minute interval of programming. Similarly, the set top terminal  
10 220 can sense that the programming has closed caption information available and place  
11 a closed caption logo on the screen.

12 Referring to Figure 19b, when the subscriber sees the interactive logo 1134 on the  
13 television screen, the subscriber is made aware of the fact that interactive services are  
14 available in conjunction with his television program. If the subscriber presses the  
15 interactive remote control button, another overlay menu 1133 will be generated by the set  
16 top terminal 220 and placed on the screen. This overlay menu 1133 is shown in Figure  
17 19b being overlayed on an interactive television program. From this menu 1133, the  
18 subscriber may select a variety of different types of textual interactivity with the current  
19 television program, as at 1134, including quizzes, fast facts, more info, where in the  
20 world, products, etc. At any time during the interactive submenus, the user may return  
21 to the television program without interactive features.

22 Another submenu 1136 gives additional information related to the television  
23 program to the viewer in textual form in the lower half of the screen. In Figure 19b, the  
24 submenu 1136 shows the available interactive options for the subcategory "quiz." In this  
25 interactive subcategory, the user is presented with questions and a series of possible  
26 answers. If the subscriber desires, the subscriber selects one of the answers to the quiz  
27 question. After the selection, the set top terminal 220 sequences to another menu. The  
28 set top terminal 220 sequences to the interactive quiz answers submenu which informs

1 the subscriber whether the correct answer was or was not chosen. Subsequently, another  
2 submenu would show correctly or incorrectly answered quiz question.

3 Figure 20a is an example of a submenu for Level B interactive services. From  
4 this menu screen 1141, any of a number of on-line data services could be accessed. One  
5 service, the airline reservations selection 1142, has been chosen by the subscriber on this  
6 menu.

7 In selecting airline reservations, the subscriber encounters a sequence of menus  
8 as for any on-line data service. Referring to Figure 20b, the subscriber is typically shown  
9 a submenu, such as submenu 1144, for the data service offering various options. In each  
10 of these submenus related to a data service, the subscriber is able to exit, returning to the  
11 home menu 1010 or regular cable TV.

12 Figure 20b, the airline information and reservation submenu 1144, allows a  
13 subscriber to view six available flights. A subscriber may select one of the flights to  
14 check on its availability. Another similar submenu allows a subscriber to enter the  
15 month, day and year for the availability date desired. In this submenu, the subscriber is  
16 offered the option of correcting any errors in the entered information.

17 Figure 20c is another airline submenu 1150 that allows a subscriber to view  
18 remaining seats available on a flight, enabling the selection of a seat assignment. This  
19 interactive submenu 1150 is an example of how information may be graphically shown  
20 to a subscriber using a portion of the menu and different coloring schemes. In this  
21 interactive menu, the lower half of the screen 1152 shows the passenger compartment of  
22 an airplane with all the seat locations graphically represented by square blocks. By  
23 coloring the available seat locations in blue and the unavailable seat locations in a  
24 different color, the menu can present a great deal of information in a limited amount of  
25 space. This graphic presentation of information for the interactive on-line data services  
26 is an important method of visually displaying large amounts of information to the  
27 subscriber.

28 Referring to Figure 20d, another submenu 1156 allows the subscriber to choose  
29 a one-way or round-trip ticket, to confirm reservations and to charge an airline ticket by

1 credit card, choosing the appropriate strip menu on the lower part of the screen. In this  
2 particular menu 1156, the subscriber is charging a round-trip plane ticket on a credit card.  
3 The subscriber simply needs to enter the credit card number, expiration date, and credit  
4 card type to charge an airline ticket. Other submenus may process the subscriber's credit  
5 card charge for the airline ticket, confirm the subscriber's airline ticket purchase, and pass  
6 this information to the location where the ticket is printed.

7 Using the methods and hardware described, a variety of interactive services are  
8 possible. Those skilled in the art will recognize that such interactive services may be  
9 accommodated by the preferred set top terminal 220.

10 g. Caller ID

11 Using the capability of the set top terminal and a connected modem, the set top  
12 terminal is able to perform the function of caller ID. The caller ID function of the set top  
13 terminal assists the viewer in a manner similar to the caller ID function provided by  
14 telephone companies. However, the set top terminal is able to use the television as its  
15 display means to communicate to the viewer information about incoming telephone calls.  
16 Also, the strong local processing capability of the set top terminal allows the caller ID  
17 function to be much more user friendly and convenient

18 If the set top terminal senses that a viewer is using the system and watching  
19 television, then the caller ID feature would automatically be activated. When the caller  
20 ID function is active, the set top terminal software will monitor incoming telephone calls  
21 to the viewer through the modem. After the set top terminal senses that the phone is  
22 ringing, signals are received on the tip and ring lines of the telephone, the system will  
23 immediately look for incoming telephone data identifying the telephone number from  
24 which the telephone call was initiated.

25 Upon receiving the telephone number from which the call was initiated, the  
26 preferred embodiment of the caller ID compares the telephone number with a list of  
27 telephone numbers stored in memory. The list of telephone numbers stored in memory  
28 is cross referenced to a list of names, other textual data or graphics. When the set top  
29 terminal finds a match between the telephone number and a number stored in memory,

1 the corresponding text or graphics are displayed on the television screen. For example,  
2 "GRANDMA" and a "smiley face" graphic can be flashed across the television screen  
3 using an overlay menu.

4 In this manner the viewer may see the name (and identifying icon graphics) of the  
5 person placing the call and can decide whether to activate an automatic telephone  
6 message recording system or answer the telephone call. After generating an overlay  
7 menu, the set top terminal software awaits an IR command signifying a viewer response.  
8 With the simple depression of a button on the remote control, the viewer can instruct the  
9 set top terminal to send an activation signal to the automatic telephone message system  
10 (through a set top terminal port). Thus, the viewer can continue to watch a program and  
11 know the identity of a caller without taking his or her eyes off the television. If a dumb  
12 telephone message system is used, the viewer can simply allow the telephone to ring the  
13 requisite number of rings until the telephone answering machine normally activates and  
14 answers the call.

15 In an alternative embodiment, having no stored telephone numbers, the set top  
16 terminal may just flash the incoming telephone number on the screen using an overlay  
17 menu. In a more sophisticated embodiment, a microphone is provided in the set top  
18 terminal or remote control unit. Using the television's speakers, a remote control, and a  
19 microphone, the viewer is able to answer the telephone using the keys of the remote  
20 control without taking his or her eyes off the television screen.

21 h. Digital Audio Capability

22 Referring to Figure 21, the digital audio feature of the invention allows a  
23 subscriber to listen to CD quality audio selections through the subscriber's stereo (not  
24 shown). This can be accomplished by running cables directly from the set top terminal  
25 220 (which may include a Level D hardware upgrade) to the subscriber's amplifier/stereo  
26 system. Alternatively, the subscriber may listen to audio selections through the  
27 subscriber's television system.

28 In the preferred embodiment, the digital audio feature uses a Level D hardware  
29 upgrade as a digital radio tuner. This Level D hardware upgrade enables a subscriber to

1 use the program delivery system's digital audio signaling capability. Digital audio  
2 transmissions require much less bandwidth than that used for the transmission of a digital  
3 video signals. Thus, hundreds of digital audio programs are delivered to each set top  
4 terminal 220 in limited segments of bandwidth.

5 Where digital audio programs are delivered to the set top terminal 220, the Level  
6 D upgrade (shown in Figure 12b) provides the subscriber with the means to select a given  
7 digital audio program for listening.

8 The Level D hardware upgrade makes use of a tuner 603 that is separate from the  
9 tuner 603 used by the set top terminal 220 for video display. The digital audio signal is  
10 received at the set top terminal 220 over the CATV transmission media. The set top  
11 terminal 220, in turn, routes the digital audio signal to the components of the Level D  
12 hardware upgrade. These components may include: a tuner 603, demodulator 606,  
13 demultiplexer 609, decryptor, decompressor 622, remote control interface and  
14 microprocessor 602.

15 The Level D hardware upgrade will use its tuner 603 to tune to the specific digital  
16 audio program selected by the subscriber and subsequently demodulate, demultiplex and  
17 decrypt the digital audio signal. Upon completion of this processing, the digital audio  
18 signal will be decompressed to produce a processed digital audio signal ready to be  
19 output to the subscriber's stereo or directly to speakers.

20 The Level D hardware upgrade includes ports for the digital audio signal output,  
21 which provide the necessary connections for transmission of the signal from the Level  
22 D hardware upgrade to the subscriber's stereo. In addition, the Level D hardware  
23 upgrade include a small LED display that can show the channel number of the program  
24 selected, date and time, among other display fields.

25 The Level D hardware upgrade can be physically located in a different room from  
26 that of the television and set top terminal 220. Thus, the Level D hardware upgrade will  
27 have its own remote control device (not shown), albeit with less available options and  
28 keys than the set top terminal's remote control 900 described above. This Level D  
29 hardware upgrade remote control is more limited than the set top terminal's remote

1 control 900 since the Level D remote control will be used exclusively for digital audio  
2 program selection. This limited remote control, nevertheless, includes a small LED or  
3 LCD display that is used to display the channel number of the digital audio program  
4 selected. Alternatively, the set top terminal's remote control may be programmed for use  
5 with the Level D hardware upgrade so that an additional remote control is not required  
6 to use the digital audio feature.

7 Using either remote control embodiment, the subscriber accesses the Level D  
8 hardware upgrade to select a digital audio program. The remote control sends an IR  
9 command signal to the Level D hardware upgrade, instructing the unit's microprocessor  
10 602 to initiate the selection of a given program. The desired program is processed (i.e.,  
11 tuned, demultiplexed, decrypted and decompressed) as described above and transmitted  
12 to the subscriber's stereo for listening.

13 The selection of a digital audio program does not necessarily require interaction  
14 with the subscriber's television. Instead, all communications required to select a digital  
15 audio program may occur between a remote control and the Level D hardware upgrade.  
16 As a result, the subscriber's television need not be turned on for the digital audio  
17 capability to operate.

18 Alternatively, the Level D hardware upgrade can be co-located with the set top  
19 terminal 220 and the subscriber can select a digital audio program through a menu  
20 displayed on the subscriber's television. In this embodiment, the subscriber would use  
21 the set top terminal remote control to access a digital audio program selection menu.

22 In an alternative embodiment, the set top terminal 220 includes all the features of  
23 the Level D upgrade and, therefore, no upgrade is necessary. Those skilled in the art will  
24 recognize other alternatives that allow digital audio reception.

25 Figure 21 is a major menu 1160 displaying the digital audio program choices  
26 which are available for subscribers who have paid the monthly fee. In a chart format  
27 1162, the major menu shows the top five, ten, and forty songs available in six different  
28 categories of music. Below the chart, the system is able to provide a text message 1164  
29 describing the particulars of the audio program selected. Using the same logos and menu

1 format, the system can provide a text description enticing the subscriber to pay the  
2 monthly fee and join the service. For example, one menu may allow the user to test the  
3 system with a free demonstration. Another menu allows the subscriber to request  
4 additional promotional information about the system. Such menus may be used  
5 throughout the menu system.

6 From any of the menu screens for the digital audio feature, the subscriber may  
7 return to regular cable TV with the press of a single button.

8 i. VCR Control

9 Referring to Figure 22, the advanced system of the set top terminal 220 is used  
10 to control video tape machines and simplify recording programs using a Guide Record  
11 feature. The set top terminal 220 has a separate output 650 for a VCR. Control signals  
12 are transmitted through the VCR output of the set top terminal 220 and input to the VCR  
13 to allow the VCR to be automatically controlled by the set top terminal 220. Using the  
14 set top terminal 220, certain programs are selected by a subscriber from menus, and the  
15 VCR will be automatically activated to record the selected program.

16 In order to accommodate the VCR control feature, the set top terminal 220 sends  
17 instructions or control signals to the VCR. Such control signals are initiated by the set  
18 top terminal's microprocessor 602 and passed to the VCR either using a separate  
19 connection or as part of the video signals processed for display on the subscriber's  
20 television. These control signals are sent directly from the advanced set top terminal 220  
21 to the VCR, instructing the VCR when to begin and end taping of a particular program.

22 The microprocessor 602 coordinates the dissemination of control signals sent to  
23 the VCR, storing the content of such signals in local memory. Upon nearing the time for  
24 the program to be displayed, the microprocessor 602 activates the menu generation  
25 software to display a notification menu or screen, notifying the subscriber that the  
26 program is nearing the time for display. This reminder will also request the subscriber  
27 to check whether a tape has been inserted into the VCR itself.

28 The subscriber can initiate the VCR control feature by accessing a VCR control  
29 submenu, which requests whether the subscriber wishes to record a program selected for



1 future viewing. In this way the subscriber interactively enters such information on the  
2 menu screen or display using any of the hardware described above that accommodates  
3 subscriber interactive response capabilities.

4 In the preferred embodiment, the subscriber will use a movie library in  
5 conjunction with his VCR or other video taping machinery. The movie library is a menu  
6 selectable list of available movies. In that way, a subscriber may tape movies which are  
7 shown at inconvenient start times for later viewing. By enabling the proper features of  
8 the set top terminal 220, a subscriber can have the terminal activate the television and the  
9 VCR and perform all the functions necessary to tape a movie.

10 After the VCR control feature is initiated, a menu screen confirms the movie  
11 selection, start date and start time and informs the subscriber that the VCR will be  
12 automatically turned on. During this submenu, the user may return to the movie library  
13 major menu, or regular TV or cancel the movie library order by pressing the escape  
14 button. This menu shows that the subscriber has chosen to return to regular TV. The  
15 subscriber's VCR or other video taping equipment must be connected to the set top  
16 terminal 220 for the automatic taping feature to operate.

17 Following a program choice, a program description submenu is placed on the  
18 television screen. In addition, from this program description submenu, the viewer may  
19 choose to record the selected program on his VCR using the guide record feature. If the  
20 guide record feature is chosen, the guide record submenu 1170 shown in Figure 22  
21 provides the subscriber with further instructions. In order for the set top terminal 220 to  
22 perform the guide record functions and operate the VCR, control signals are sent from  
23 the set top terminal 220 to the VCR via the video connection 650 or through a separate  
24 connection between the set top terminal 220 and the VCR. The VCR is capable of  
25 interpreting these control signals from the set top terminal 220 and performing the desired  
26 function (such as, activating the record feature). In the preferred embodiment, the VCR  
27 control signals are sent with the video signal and output from the output 650, as described  
28 above. Alternatively, a separate connection between the set top terminal 220 and VCR  
29 may be used.

j. HDTV Capability

The set top terminal 220 and program delivery system of the preferred embodiment can easily support high definition television (HDTV). The combination of digital video, compression and no restricted bandwidth limitation per channel makes the preferred system ideal for HDTV. The greater information flow of HDTV causes no problems for the system. The menu selection system of the preferred embodiment is a user friendly manner of presenting HDTV programming to the subscriber.

Figure 23 shows the integration of HDTV services into the menu-driven program delivery system. If the subscriber selects the major menu for HDTV 1032, the subscriber will receive either a description of the service with a suggestion to order the system, or a text note that the subscription is current and a listing of the currently available program selections in HDTV. If the subscriber has not paid to join the particular service, HDTV, the subscriber may be allowed to join one of the programs in progress for a limited time as a demo to entice the subscriber to order.

If a subscriber has paid the HDTV fees, the subscriber proceeds as in any other major menu screen. This particular major menu shows an example of how a follow-on or second screen may exist for the same menu. In this particular case, a second screen exists for the major menu HDTV 1032. The subscriber may access the second screen by selecting the last menu display block 1172 "Other HDTV Selections" in the lower part of the screen. Following this selection, the subscriber will be given a second screen of program selections. In this manner, any menu can have multiple screens with many program choices. This type of screen pagination on one menu allows the operations center 202 packager to avoid categorizing program selections within that same menu. In an alternative embodiment, the options available to the subscriber may be scrolled on one menu screen with the text within the menu display blocks changing as the subscriber scrolls up or scrolls down. Many variations of this HDTV example can be used with the described system.

k. Backyard System

In an alternative configuration, in areas without cable services where subscribers use backyard satellite systems (TV RO) to receive packaged television services, the set top terminal 220 will include the appropriate hardware to allow connection to the satellite 206 reception equipment through port 656. In this configuration, the menu system within the set top terminal 220 will be programmed directly from the operations center 202. Additionally, an upstream communication mechanism must be in place at the subscriber's home (i.e. modem) to communicate information to the operations center.

The hardware components that allow the set top terminal 220 to operate in a backyard system typically will not be included within the set top terminal shell itself. Instead, any such components accommodating the set top terminal's interoperability with a backyard program delivery system will typically reside outside the subscriber's home. As a result, the set top terminal 220 will operate as described above, notwithstanding any change in program delivery transmission media.

The terms and descriptions used herein are set forth by way of illustration only and are not meant as limitations. Those skilled in the art will recognize that numerous variations are possible within the spirit and scope of the invention as defined in the following claims.